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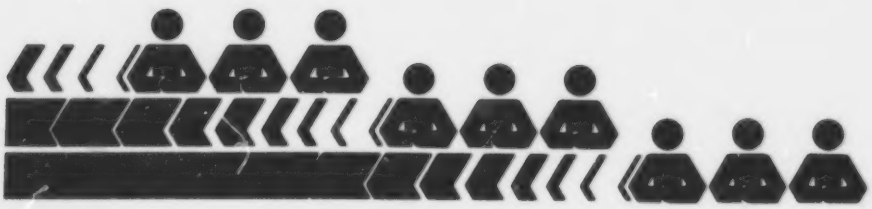
Teleconferencing Technology and Applications in Canada



Teleconferencing Technology and Applications in Canada

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TABLE OF CONTENTS

	PAGE
PART 1/ INTRODUCTION	1
1/ TECHNOLOGY	2
2/ SYSTEM DEVELOPMENT	2
3/ HUMAN FACTORS.	3
4/ APPLICATIONS	3
5/ MARKET	4
PART 2/ TELECONFERENCING TECHNOLOGY	5
1/ INTRODUCTION	6
2/ AUDIO TELECONFERENCING	6
2.1/ Network	6
2.2/ Audio Terminals	6
2.3/ Bridges	7
3/ WRITTEN, VISUAL, AND GRAPHIC MATERIAL.	8
3.1/ Slow-Scan or Freeze-Frame Video	9
4/ FULL-MOTION VIDEO.	11
4.1/ Transmission.	11
4.2/ Studio Design	13
4.3/ Implications.	13
5/ ENDNOTES	14
PART 3/ SYSTEM SELECTION	17
1/ INTRODUCTION	18
2/ FEASIBILITY.	18
2.1/ Organizing for the Feasibility Study.	18
2.2/ Identifying the Alternatives.	19
3/ FEASIBILITY ANALYSIS	21
3.1/ Feasibility Analysis.	25
3.2/ The Feasibility Decision.	26
3.3/ Determining System Requirements	26
3.3.1/ Introduction.	26
3.3.2/ Needs Assessment.	26
3.3.3/ Developmental Approaches.	28
4/ ENDNOTES	29
5/ REFERENCES	29
6/ BIBLIOGRAPHY	32
PART 4/ HUMAN FACTORS IN TELECONFERENCING	38
1/ INTRODUCTION	39
2/ ERGONOMICS: USERS AND THE SYSTEM.	39
3/ INTERPERSONAL COMMUNICATIONS: USING THE SYSTEM TO FACILITATE, NOT IMPEDE COMMUNICATIONS.	41
3.1/ Administration.	41
3.2/ Promotion	43
3.3/ Training.	44
3.3.1/ Rationale: Why Train?.	44
3.3.2/ What Does Training Do?.	44
3.3.3/ The Training Program.	46
3.3.4/ Audiovisuals.	49

PAGE

4/ ISSUES FOR FURTHER CONSIDERATION 50
4.1/ Power 50
4.2/ Body Language 51
4.3/ Energizing. 53
4.4/ Bonding/Cohesion. 54
5/ ENDNOTES 55
6/ REFERENCES 55
7/ BIBLIOGRAPHY 56

PART 5/ BUSINESS APPLICATIONS 60
1/ INTRODUCTION 61
2/ OVERVIEW 61
2.1/ Survey Methodology. 61
2.2/ Type of System. 61
2.3/ Extent of Use 62
2.4/ Applications. 62
3/ ATTITUDES TO TELECONFERENCING. 63
3.1/ Advantages and Disadvantages. 63
3.2/ Attitude Statements 63
4/ BUSINESS TRAVEL. 64
5/ CHARACTERISTICS OF COMPANIES 65
6/ TRAVEL SUBSTITUTION. 66
7/ CASE STUDIES 66
7.1/ Bank of Montreal. 66
7.2/ Polysar 67
7.3/ 3M. 67
7.4/ CBS Records 68
7.5/ Consult Limited 68
7.6/ Digital Equipment Corporation (DEC) 68
7.7/ Motorola Canada 68
7.8/ Lavalin 69
7.9/ Telemedia 69
7.10/ Valhalla Companies Limited 69
7.11/ Wood Gundy 69
7.12/ The Cooperators General Insurance Company. 70
7.13/ IBM. 70
7.14/ Royal Bank of Canada 71
7.15/ Bell Canada. 71
7.16/ Westinghouse 72
7.17/ Honeywell. 72
7.18/ General Motors 72
7.19/ Pratt & Whitney. 73
7.20/ Dominion Securities Pitfield 73
8/ REFERENCES 73

PART 6/ GOVERNMENT APPLICATIONS 83
1/ INTRODUCTION 84
2/ ONTARIO'S EXPERIENCE 84
2.1/ Background. 84
2.2/ User Needs. 84
2.2.1/ MTC Surveys 85

PAGE

2.2.2/ Ministry of Government Services (MGS) Pilot Projects. . . 85
2.3/ Operational Systems 86
2.3.1/ Audio 86
2.3.2/ Audio Plus Visual Support 86
2.3.3/ Full-Motion Video 87
2.4/ Training and Promotion. 87
2.5/ Usage 88
2.6/ Evaluations 88
2.6.1/ Ministry of Transportation and Communications (MTC) . . 88
2.6.2/ Ministry of the Environment (MOE) 88
2.6.3/ Telephone-Based Systems 89
2.7/ Promotional Programs. 90
2.7.1/ TEMP Teleconferencing Task Force. 90
2.7.2/ Approach. 90
2.7.3/ Achievements. 90
3/ OTHER PROVINCIAL GOVERNMENTS 90
4/ THE FEDERAL GOVERNMENT OF CANADA 92
5/ REFERENCES 93

PART 7/ TELECONFERENCING IN HEALTH 97
1/ INTRODUCTION. 98
2/ TECHNOLOGY. 98
2.1/ Audio. 98
2.2/ Video. 101
2.3/ Slow-Scan Video. 103
2.4/ Electronic Graphics. 104
3/ RANGE OF APPLICATIONS 105
3.1/ Administration 105
3.2/ Social-Therapeutic 105
3.3/ Health-Care Delivery 105
3.4/ Education. 106
4/ CONCLUSION. 107
5/ ENDNOTES. 107
6/ REFERENCES. 108
7/ BIBLIOGRAPHY. 109

PART 8/ TELECONFERENCING IN EDUCATION 110
1/ INTRODUCTION. 111
2/ WHO IS USING IT 112
3/ RANGE OF USES 113
4/ TECHNOLOGY USED 114
4.1/ Conveners. 114
4.2/ Electronic Blackboards 115
4.3/ Telidon. 115
4.4/ Slow-Scan. 115
4.5/ Computers. 116
4.6/ Full-Motion. 116
5/ OVERVIEW OF EDUCATIONAL TELECONFERENCING. 117
5.1/ Atlantic Canada. 117
5.2/ West Coast 118
5.3/ Prairies 118

PAGE

5.4/ Central Canada 119
6/ ISSUES IN EDUCATIONAL TELECONFERENCING. 121
6.1/ Trans-Border Delivery and Credit Transfer. 121
6.2/ Regulations. 122
6.3/ Training, Delivery, and Support. 122
6.4/ Need of New Technology 123
6.5/ Financing. 123
6.6/ Evaluation 123
7/ CONCLUSION. 125
8/ ENDNOTES. 125
9/ REFERENCES. 126
10/ BIBLIOGRAPHY 128

PART 9/ THE TELECONFERENCING MARKET: PAST AND PRESENT PROSPECTS 134
1/ INTRODUCTION. 135
2/ NATURE OF JOB OR ACTIVITY 135
3/ COST BENEFITS 135
4/ USER AWARENESS AND ATTITUDES. 136
5/ PRODUCT AVAILABILITY, QUALITY, AND MARKETING. 137
6/ THE GOVERNMENT AS CATALYST. 137
6.1/ Demonstrations 139
6.2/ Publicity. 139
6.3/ Training and Implementation Assistance 139
6.4/ Development of Products and Services 140
6.5/ Research 140
6.6/ Results. 140
7/ OUTLOOK 140
8/ ENDNOTES. 141
9/ REFERENCES. 142

LIST OF TABLES

PAGE

PART 2
1/ Advantages and Disadvantages of Various Media 15
2/ Comparison of Media 16

PART 3
1/ Cost Comparison: Toronto to Montreal 33
2/ Characteristics of Office Workers 34
3/ Attitudes of Users. 35

PART 5
1/ Type of Teleconferencing Used 75
2/ Median Frequency of Use of Teleconferencing Devices 75
3/ Applications of Teleconferencing. 76
4/ Expected Use of Teleconferencing. 76
5/ Advantages of Teleconferencing. 76
6/ Disadvantages of Teleconferencing 77
7/ Attitudes Towards Teleconferencing. 78
8/ Business Travel Patterns. 79
9/ Steps to Reduce Travel. 80
10/ Summary Profile of Firms 81
11/ Perceived Effect of Teleconferencing on Travel 81
12/ Estimates of the Effect of Teleconferencing on Future Business Travel. 82

PART 6
1/ Evaluations 96

PART 8
1/ Universities and Colleges Having Experimented with Teleconferencing for Delivery or Support of Distance Education. 132

PART 9
1/ Characteristics of Meetings 143
2/ AT and T Study of Meeting Activities. 143

LIST OF FIGURES

PART 3
1/ Meeting Requirements 36
2/ Substitutability of Meetings 37

PART 1/

INTRODUCTION

1/ TECHNOLOGY

Teleconferencing can be defined as "a means of linking three or more individuals in separate locations, electronically." It is, therefore, an application rather than a technology, although several technologies can be used, including audio, graphic, computer, freeze-frame, and full-motion video systems. Each form of teleconferencing presents certain capabilities and limitations.

Most evidence suggests that audio alone is sufficient for many meetings, particularly if visual aids can be distributed in advance. Components include terminals (devices to allow groups to participate in one location), bridges (devices used to connect three or more sites simultaneously), and the network or transmission medium. The principal advantage of audio teleconferencing is that it is universally available and relatively inexpensive. However, participants must compensate for the lack of visual cues. Various devices can be used to support audio, including computer terminals for text and graphics; facsimile machines or telecopiers, which transmit anything that can be photocopied; as well as interactive graphic devices, which transmit hand-drawn pictures and words over the telephone network. Most of these devices present relatively inexpensive ways of transmitting visual information. Unfortunately, they are usually single purpose and not compatible.

Freeze-frame video is somewhat more flexible: it allows still images of people, objects, charts, or graphs to be exchanged over the telephone network. However, transmission time for high-resolution pictures using conventional technology can be long, as much as two minutes per image.

Full-motion video, on the other hand, which is essentially two-way television, transmits moving pictures. It is the technology that everyone wants but few can afford, and access is provided only in certain locations. Despite popular perceptions, evidence indicates that simple systems can accommodate most (64%) meeting requirements and that full-motion video is required for a small percentage (10%) of applications.

From an economic standpoint, the least costly means of satisfying the requirements is the most efficient. Users, however, appear to require more information to identify the full range of options and to systematically compare them.

2/ SYSTEM DEVELOPMENT

Often, initial interest in teleconferencing is generated by an awareness of the technology -- most often video -- and frequently, the process is technology driven without any formal needs assessment. Because teleconferencing is usually perceived, initially at least, as an alternative to travel, any evaluation of the existing system tends to focus on identifying current travel and communications patterns. Various techniques are used to collect information about potential benefits -- formal surveys, interviews, and literature reviews. Sometimes added-value benefits, such as improved decision making, increased efficiency, and so on are considered, although these are not easy to measure.

In many cases, it is argued that costs and benefits cannot be evaluated in advance. This is particularly true, it seems, where extremely costly systems are being considered. Occasionally, decisions are made to proceed with pilot projects to acquire more information on costs/benefits and potential applications. Unfortunately, pilot studies are not always well designed and may develop a life of their own, gradually becoming operational without any formal assessment ever being made.

The depth of analysis in the feasibility stage varies: the feasibility decision may be approval to proceed with teleconferencing in principle, with video conferencing, with a pilot project to obtain more information, or to install a fairly well-defined system. The detail acquired at this stage impacts significantly on the depth of analysis required in subsequent stages: that is, if a fairly in-depth needs assessment is undertaken in the feasibility stage, less work is required in developing functional specifications. Of course, this involves more risk: if substantial resources are committed to assessing needs and the result is a decision not to proceed, a great deal of effort and time has been wasted. On the other hand, if insufficient detail is obtained, the assumptions on which the feasibility decisions have been based may be faulty.

3/ HUMAN FACTORS

Once a technology is selected, careful attention to human factors is essential to its successful implementation. The system must be developed with users' needs in mind. Location, comfort, and ease of operation are important considerations. But technology is only part of teleconferencing system implementation: administration and training are also essential components.

4/ APPLICATIONS

In Canada, teleconferencing is being used in virtually every sector for a wide range of applications. The majority of businesses use some form of teleconferencing, although the extent of use varies significantly. Audio predominates, but other forms are growing in popularity. The specific uses are virtually endless: information exchange, project reviews, operations updates, planning, co-ordination, training, and even public relations.

Likewise, in government, many different functional areas and activities are represented. Several provinces, including Ontario, along with the federal government, have systems in place. The Ontario government is unique in that it has also actively promoted teleconferencing within and without as part of its Transportation Energy Management Program (TEMP)

Teleconferencing in health care or telehealth has been used for many years on an experimental basis, and a number of operational systems have been well documented. Clinical applications are still relatively uncommon, although systems have been used for such diverse activities as psychiatric patients and transmitting X-rays and ultrasounds to specialists.

The principal uses of technology in the health field are for administration and continuing education: programs have been offered across the country to physicians, nurses, allied health professionals, and administrators. Again, audio systems are the most frequently used.

Distance education is very well developed in Canada, largely owing to the challenges presented by the country's geography and relatively widely spaced population. A large number of universities and colleges offer credit and non-credit programs in virtually every subject area. The effectiveness of teleconferencing as a delivery mode has been well established: remote students often exhibit greater satisfaction and higher levels of performance than their on-campus class mates. Once again, audio conferencing, usually supported with handouts and/or slides is the most common form.

5/ MARKET

While a number of pioneering teleconferencing projects were established in Canada, particularly in education, the teleconferencing market has lagged behind the US in some segments, notably business. A number of factors have contributed to this, including limited awareness; limited projects and marketing; as well as economic, social, and political forces. In recent years, there has been significant growth in Canadian teleconferencing, owing to the efforts of the Ontario government plus other factors.

This report draws from a wide range of sources in an effort to review teleconferencing in Canada: the technology, system selection, implementation, applications, and trends for prospective users.

PART 2/

TELECONFERENCING TECHNOLOGY

1/ INTRODUCTION

While the rate of technological change is mind boggling, the assimilation of teleconferencing technology in Canada over the past few years has proceeded at a modest pace. With some exceptions, the systems which are most popular today are not dramatically different than those used five years ago, even though the options available have increased considerably. While there is some spillover from the United States, particularly to subsidiaries, only a handful of new suppliers have entered the Canadian market.[1]

2/ AUDIO TELECONFERENCING

Audio teleconferencing refers to discussions involving three or more people in two or more locations, where voice is the means of communication. It has been available for over 50 years and is by far the most commonly used form of teleconferencing. Although audio is simple, various options are available for the network, terminals, and bridge.

2.1/ Network

In Canada, the public switched telephone network is most commonly used for audio conferencing. It is almost universally available, easily accessible, and relatively inexpensive. Line quality is variable, depending on the random selection of circuits. Because the local loops are generally two-wire, the telephone network presents certain challenges, particularly for multi-point conferencing. While quality is expected to improve with the advent of digital switching and transmission, the network is only as good as its weakest link.

The CNCP broadband, on the other hand, is a four-wire data network, which can be used for voice communications. It offers the advantages of full-duplex audio teleconferencing without the high cost of a private network. Four-wire networks have two separate transmission paths, one for sending and one for receiving. This results in better audio quality than on two-wire networks and eliminates the need for voice-switching. However, the CNCP broadband network is not as universal as the telephone network, nor is it well supported as a teleconferencing product.

Currently it is used only by a small number of organizations, including several Ontario government ministries. Private or dedicated networks, two and four-wire networks, can be installed between pre-determined locations. However, because they present high fixed costs, they can only be justified where the projected frequency of use is high. Memorial University in Newfoundland has a dedicated four-wire network linking sites on the Island and in Labrador.

2.2/ Audio Terminals

Audio terminals are the equipment used for voice communication in a teleconference. The most commonly used terminal is the regular telephone set. A vast array of speaker/microphone units can be used to accommodate

groups at any location. Speakerphones are often used to permit hands-free participation or to accommodate small groups. For larger groups, more sophisticated units may be used. Northern Telecom's Conference 2000 and Darome's 1610 convener are the most common mid-size group terminals used in Ontario. The Conference 2000 is a large hands-free unit with an omni-directional, open microphone which is voice-switched. The Darome 1610 convener uses press-to-talk microphones and is particularly popular for educational applications. Both units cost between $1000 and $1500. However, a number of more sophisticated systems are available. Some use microprocessors to adjust to particular line and room conditions. Others use microphones that can deliver broadcast quality sound. High quality, off-the-shelf, audio systems can cost up to $15 000, custom-designed systems even more.

2.3/ Bridges

Conference bridges, required to connect three or more locations simultaneously for multi-point discussion, range widely in terms of capability, cost, and quality. Several public services are available to establish multi-point calls, on an occasional basis. Bell offers two services: Conference 100, or traditional conference calling; and Conference 200, a meet-me service introduced a few years ago. With Conference 100, the operator initiates the call and bridges locations together. Costs are operator-assisted rates plus a conference charge. With Conference 200, participants enter a conference by dialing an assigned number. The originator pays a conference charge, and participants pay long-distance charges to the bridge. Audio quality for either service depends on the quality of the lines and call routing.

While commercial third-party conference services had operated in the US for many years, Darome Connection initiated the concept north of the border in 1984. The company operates a meet-me conference service. Participants dial a pre-set number and are linked by an operator who monitors the technical quality of the conference and provides customized services.

Many organizations have limited bridging capability in their switchboards. Most new Private Branch Exchanges (PBX) have some conferencing capability, although the quality varies. Others elect to purchase teleconferencing bridges, which also range in quality and capability. Both Wescom Canada and Interdaco manufacture small, automatic bridges in the $6000 range. Larger bridges with more capability are also available: for example, Darome Canada, markets 10- and 20-port bridges, which permit an operator to monitor and control the quality of the conference.

While audio is the foundation of good teleconferencing, the technology currently available has some limitations. The telephone network presents certain problems that must be addressed in linking more than two sites together. As sites are added together, the following problems occur:

- The noise and echo on the lines are accumulated.

- Variations in the levels of lines become more obvious. Hence, a speaker in Vancouver may sound as if he's next door, whereas the speaker from Halifax may sound as if she's far away.

- Bridges embedded in PBXs usually do not compensate for line loss and differences in voice levels. In other bridges, such as Darome's Co-convener, amplification is introduced to compensate for loss. However, with amplification, noise and echo are also increased, as is the risk of feedback. For this reason, many bridges, such as Darome's, introduce voice switching to prevent feedback and echo, as do some terminals.

- Only one site call can be heard at a time. Occasionally, it is difficult to interrupt someone who is speaking, and often there is some clipping of the ends of words.

Advances in digital technology have resolved some problems and promise to address others.

3/ WRITTEN, VISUAL, AND GRAPHIC MATERIAL

Audio conferencing, augmented with a means of providing textual and graphic information, can meet most meeting requirements. A survey by Satellite Business Systems (SBS) suggested that 64% of conventional meetings could be replaced with audio plus some form of still-frame transmission. Only 10% were thought to require full-motion.

One of the simplest and cheapest ways to provide participants in audio teleconferences with appropriate graphic, written, or visual support is to mail out materials, such as multiple copies of agenda, pictures, slides, printed documents, or vugraphs, in advance. However, the speed and reliability of regular mail is often questionable, and electronic alternatives offer a number of advantages.

When conventional mail is inappropriate, a wide range of methods are available to transmit textual and graphic information over virtually any distance: electronic mail services, facsimile machines, communicating word processors, computers, and telewriters. They are distinguished in terms of their capabilities, speed of transmission, image quality, cost, and compatibility.

Electronic mail services, telex, twx, and various computer-based mailbox services, can be used in for sending messages, agenda, etc., in advance. Naturally, communication is limited to the subscribers of the service, and most of the systems do not interconnect.

Facsimile machines or telecopiers can be used to transmit virtually anything that can be photocopied, before the meeting. High-speed machines in the conference room could be used during the meeting as well, but tend

not to be. Facsimile machines are generally divided into four categories, according to the speed and means of transmission:

1/ Group I devices use analogue transmission and can send one page in approximately six minutes.
2/ Group II devices are also analogue, but transmit in about three minutes.
3/ Group III devices are digital and can transmit in less than one minute.
4/ Standards are currently being established for Group IV devices, which are expected to transmit within seconds.

Facsimile machines are widespread, and compatibility is improving, but most cannot send documents to several locations simultaneously.

Communicating word processors are another means of distributing textual information prior to meetings. Again, compatibility is an issue as many systems cannot "speak" to one another.

Computers with communications capability are a powerful means of transmitting text and visual material before or during teleconferences. The range of options available is steadily growing with developments in software. These machines are also used without audio for "text messaging" or "computer conferencing." Many work stations and personal computers can be used to support audio conferences by creating, distributing, and displaying text and graphics. In addition, these functions are increasingly being combined with audio conferencing capability in integrated work stations. While these devices can be used by groups in boardroom environments, they can also be used by individuals for desk-top conferencing. As the "electronic office" emerges, teleconferencing is being shaped by the convergence of computer, telecommunications, and office technologies.

Broadly speaking, telewriters are devices which transmit diagrams, charts, and tables. Typically, an electronically sensitive tablet is used to create images, which are displayed on monitors in remote locations. Increasingly, telewriters are being integrated with other devices, such as captured-frame video. AT and T's Electronic Blackboard is one of the more common telewriters. As the instructor draws on an electronically sensitized blackboard, the images are displayed on monitors in remote sites. It is currently being used by the University of Ottawa to support distance education applications.

Some attempts have been made to use Telidon graphics to support audio conferencing. Bell Canada launched a trial in 1983 of this concept, marketed as Conference 500, but it was short-lived. Except in specialized applications, it seems that the cost and difficulties of page creation limit its feasibility.

3.1/ Slow-Scan or Freeze-Frame Video

Freeze-frame or slow-scan video enables an image to be transmitted via

the regular telephone network. It is ideal for exchanging visual information, such as charts, graphs, pictures, or drawings, but it is less suitable for transmitting images of people, as it may catch them in awkward positions. With ordinary television or full-motion video, requiring broadband transmission, a participant sees about 30 pictures per second, but for freeze-frame video, the information stream is reduced to a trickle for transmission over the regular telephone network. Therefore, participants see only one image every few seconds, transmission times ranging from six seconds for low resolution black and white to five minutes for high-quality colour.

In the United States, freeze-frame is used extensively by business for regular meetings, for engineering applications, and for training. Although in Canada, it is not well known, Bell Canada, IBM, Westinghouse, and General Motors have recently installed systems. There are also systems used in educational and health-care applications.

In a typical system, a regular television camera is focused on an object or illustration. A scan converter freezes the image, and a modulator converts it to an analogue signal which is sent over the telephone network to a remote site, where the image is reassembled and displayed on a television monitor, line by line, either from top to bottom or left to right. Images can be transmitted from one location to one or several locations and can be recorded on standard audio cassettes or in digital memories. The audio portion of the teleconference is usually established separately via another point-to-point or multi-point conference call. However, devices are available which can be used to multiplex the audio and video signals over one telephone line.

The principal advantage of freeze-frame video is that it can be used anywhere on the universally accessible telephone network at transmission costs equal to the price of a telephone call. Over the last couple of years, freeze-frame systems based on personal computers (PCs) have appeared. With special software, the PC can store, manipulate, enhance, compress, and transmit images, as well as create text and graphics. Moreover, these systems are easily upgradable and multi-functional. IBM is using such a system, based on the XT microcomputer, and is market-testing the system in a few other corporations in the USA. The units are expected to sell for around $70 000.

With the advent of these PC-based systems, it is hoped that standards will develop to solve the compatibility problem of freeze-frame systems, i.e., transceivers using different coding algorithms cannot "speak" to each other.

Image quality is usually affected by contrast and resolution. Contrast is measured in black-and-white freeze-frame by grey scale, the range of shades that the picture will distinguish. Grey scale levels vary: 64 and 256 are common. Resolution, on the other hand, refers to the amount of information contained per frame and is usually measured in lines. For example, 256 x 256 line resolution means that 256 lines of information

are contained vertically and 256 lines horizontally. The greater the number of lines, the more detail that can be seen in the picture. Colour freeze-frame is slightly more expensive and requires longer transmission times. Usually, there is a trade-off between speed of transmission and quality of the image. Higher quality images may be transmitted more quickly if wide bandwidth transmission lines are used. If regular phone lines are used, transmission time ranges from eight seconds to five minutes per frame. Advances in compression techniques may reduce transmission times.

Digital systems transmit more slowly than analogue systems when used on dial-up telephone lines but can be employed on a variety of transmission media. Some systems currently available can only be used in point-to-point applications; others can be linked into multi-point conferences, using audio bridges. For each image that is to be displayed simultaneously, a memory is required. For mass storage, digital systems can utilize digital memories, whereas analogue systems tend to use audio tape to store images. Costs are usually affected by requirements for quality, colour, speed of transmission, and special features, and they range from approximately $15 000 to as much as $80 000.

Most freeze-frame equipment is solid state, and servicing is not readily available, but with systems based on PCs, most servicing can be done by local suppliers. The upgradability of the system will depend on its particular design. Computer-based systems can be upgraded by adding software.

4/ FULL-MOTION VIDEO

4.1/ Transmission

Full-motion video is being used for two-way teleconferences between fixed sites and for point-to-multi-point teleconferences in which video is, in effect, broadcast to several locations and audio is interactive. Because of the complexity of switching arrangements, fully interactive video teleconferencing is, almost exclusively, limited to two-point conferences. While the differences between full-motion and compressed video technology may not be apparent from the user's point of view, they are significant in terms of design, costs, and capabilities. Full-motion video requires broadband transmission of approximately 5 MHz, as does broadcast television. A modulator is used to convert the visual image and voice to an analogue signal. Satellite, microwave, or cable may be used, but the costs are relatively high and availability limited. Encoding of this analogue signal requires about 100 megabits/second.

Compression techniques that digitize video images and reduce the bandwidth required for transmitting them to 15 megabits/second, or even 56 kilobits/second, have been developed. Transmission costs are reduced, but the costs of codecs, which are required to compress, code, and decode the information, are still high, about $100 000 or more per location. Moreover, there are no established standards, and different

manufacturers' codecs cannot yet talk to each other.

The differences between compressed and full-motion will only become apparent to users if there is more movement than the codec can process, causing a slight blurring in the image. This is particularly a problem at lower speeds, such as 56 kilobits/second. Moreover, in Canada, digital transmission facilities, typically TI carriers, required for compressed video, are costly and limited in availability. Therefore, while compressed video has made great inroads in the US, its application in Canada is presently limited primarily to the common carriers.

In Canada, the telephone companies and Teleglobe Canada provide public video conferencing studios in select locations for a $100 per site plus transmission charges. For organizations wishing to teleconference from their own premises, there are a number of options for one-time and recurring use:

- Telecom Canada can provide, on a distance-sensitive basis, broadband facilities to link specific sites with its television operating stations. Various classes of service are available, but most organizations book 48 hours in advance for pre-emptible service. Transmission may be via satellite and/or microwave, digital or analogue; the technique is largely transparent to the subscribers. Some typical costs are $225 per hour, Toronto to Montreal, and $900 per hour, Toronto to Calgary, approximating the cost of a return first-class air fare.

- Some cable television companies with two-way capabilities are providing video conferencing services within their territories, which are typically regional in scope. Because cable operators are independent, there is no established rate or level of service; both must be negotiated on an individual basis. In addition, interconnection of regional broadband cable networks with national networks may be a problem.

- Provided the organization possesses earth stations and required modulator/demodulators, they can also use Telesat's satellite services. However, because of the costs (approximately $1300 per hour for pre-emptible service), satellite is generally used only for large, one-time, point-to-multi-point conferences, or on an experimental basis. Satellite charges are not distance-sensitive, so they are economically attractive for transmitting over relatively long distances (1000 km [700 miles] or more).

- Finally, Teleglobe Canada provides international service: rates are $3000 per hour between Toronto and London, England.

There are a few examples of organizations in the United States which have established private broadband networks for teleconferencing and other applications. In general, the costs of doing so, in Canada, whether using coaxial cable, fibre optics, or microwave, are prohibitive.

4.2/ Studio Design

The designs of particular video teleconferencing systems differ radically. The appropriate number, type, and location of cameras; the size, types, and location of monitors; the size and shape of the conference table; room lighting; audio systems; acoustic treatment; and so forth, are the subject of much debate. In general, it is agreed that the technology should be transparent to users and that a video teleconference should resemble a face-to-face meeting. Some prescribe the use of voice-switched cameras to minimize participant intervention and the inclusion of life-size monitors to simulate eye-to-eye contact.

Public video conferencing studios can be rented from the telephone company. Portable video conferencing equipment, although not readily available, can be rented for up to two months. However, for various reasons, some companies prefer to install their own studios. Privately owned studios are reasonably common in the USA, but in Canada, only a handful exist: the Royal Bank of Canada, the Government of Ontario, Knowledge Network in B.C., the University of Quebec, and a group of hospitals in the London, Ontario area are the only organizations to have installed private, full-motion video facilities. The costs of these studios vary enormously: Atlantic Richfield spent over $750 000 per location for theirs; the Government of Ontario, approximately $25 000. Components can be purchased separately or special units custom- designed.

The combination of components is usually a reflection of various needs and constraints. The number of cameras required is affected by the number of functions needed. Typically, three are used: one for overviews, or for close-ups, and one for graphics. Similarly, the size and number of monitors depends on use. One may be required for "people shots," one for graphics, and one for previews. Some systems (e.g., the Royal Bank of Canada) have very large screens with rear projection to simulate face-to-face meetings. The layout and setup of the room will also depend on the capabilities required. Equipment is available with different degrees of quality. Video conferencing need not be up to broadcast standards, but it must be sufficient to fulfil the users' meeting requirements and fit with the corporate environment.

Depending on preference and budget, the video conference equipment can be operated by a technician, by the chairman of the meeting, or be fully automated. Technician-operated systems (e.g., the Government of Ontario) are more transparent to users, but security may be a concern. With a user-operated system, training and human factors engineering are required. With systems employing automatic features, such as voice-activated cameras in which cameras focus on the person speaking, participants must adjust to the equipment's capabilities.

4.3/ Implications

Each form of teleconferencing has advantages and disadvantages, making it more suitable for certain applications than for others (Table 1).

Because of the differences in terms of capabilities, applications, and cost structures, it is difficult to compare various teleconferencing technologies. However, these technologies can be compared in the following ways:

- along specific dimensions (Table 2), such as their capability to transmit verbal information, visual material, or movement;
- according to the flexibility and accessibility of the systems, in terms of the number of locations that can be accommodated in total and simultaneously;
- by the ease of operation and use and the acceptability of various technologies; and
- by determining costs for hardware, transmission, and staffing, based on certain assumptions about configuration and level of use, and mapping costs against capabilities, using certain assumptions.

In the final analysis, however, the technologies must be evaluated in terms of the particular organization's objectives, needs, and constraints. Moreover, as the capabilities of the technology improve and its costs come down, as they inevitably will, the cost benefit map will change.

5/ ENDNOTES

[1]For more information, refer to the Teleconferencing Systems Guide, rev., Ontario Ministry of Transportation and Communications, Downsview, Ontario, 1985.

Table 1/ Advantages and Disadvantages of Various Media

	ADVANTAGES	DISADVANTAGES
AUDIO ONLY		
	- low cost - widely accessible - sufficient for many meeting needs	- visuals must be sent in advance - low pheromone factor - must compensate for lack of visual cues
AUDIO GRAPHIC		
	- exchange visual information - higher pheromone factor - fulfils most meeting needs	- higher cost than audio - requires special equipment - compatibility problems - not versatile
FREEZE-FRAME VIDEO		
	- visual information, including pictures - versatile - low-cost transmission	- hardware costs - resolution inadequate for some documents - slow transmission - incompatibility
FULL-MOTION VIDEO		
	- high pheromone factor - allows movement and gestures to be observed - easy to use	- costly equipment - costly transmission - high production values may be necessary - limited availability of transmission facilities

Table 2/ Comparison of Media

	Audio	Graphic	Freeze-Frame	Full-Motion
Capability				
Discussion	Yes	Yes	Yes	Yes
Visuals	In Advance	Yes	Yes	Yes
Expressions	No	No	No	Yes
Ease of Use				
Operation	Easy	Moderate	Moderate	Easy
Preparation	Yes	Some	Some	Little
Pheromone	Low	Moderate	Moderate	High
Flexibility				
Access	Wide	Depends on Hardware	Depends on Hardware	Depends on Hard-ware & Network
Multi-Site	Yes	Yes	Yes	One-Way Only
Compatible	Yes	No	No	Yes, Unless Codecs Used

PART 3/

SYSTEM SELECTION

1/ INTRODUCTION

The implementation of teleconferencing in any organization is a multiphase process that requires attention to human, organizational, and technical factors. Structured approaches to system selection usually begin with a feasibility study, followed by the assessment of detailed requirements and system design. Once the system is designed, a supporting administrative structure must be developed, users must be trained and the concept promoted and followed by an evaluation. The process is not sequential but iterative: the technology and user requirements must be considered in the feasibility stage as well as in the evaluation. While structured approaches can be manipulated to certain ends, ideally they ensure that the optimal solution is selected to fit with an organization's needs, objectives, and constraints. In reality, however, relatively few organizations appear to have adopted a systematic approach to teleconferencing.

The feasibility stage, which includes a preliminary assessment of the problem, the options, and their costs and benefits, can be used to evaluate the business case for teleconferencing and to obtain resources necessary for more detailed needs assessment.

2/ FEASIBILITY

2.1/ Organizing for the Feasibility Study

The way in which interest in teleconferencing develops varies from organization to organization. In many cases, there is no formal assessment of feasibility or systematic attempt to assess needs or evaluate the options. Because public services are available, use may begin without any formal organizational approval. Even when equipment is acquired, purchases may be buried in the operating budgets of specific divisions. As a recent survey indicated, in most cases (90%), teleconferencing is initiated by prospective users rather than suppliers [1]. Typically, individuals acting as advocates play a key role in the introduction of teleconferencing. Most people believe that senior management support is essential to the success of teleconferencing. Often, investigations of teleconferencing have been initiated at senior levels, but senior management's interest is usually sparked by video conferencing. While in some cases they have been persuaded to consider audio where "video was neither technically not financially feasible," they usually demand video or nothing.

Many organizations have adopted systematic approaches to assessing the feasibility and determining the system requirements for teleconferencing; others have not. The reasons organizations consider teleconferencing are not always explicit, nor are the objectives for the system. Unspoken traditions and desires, and different goals and constraints, may drive the design process. The objectives for systems vary, as do the criteria used to evaluate the alternatives. Often there is a discrepancy between explicit and implicit objectives. For example, the "pheromone factor or sex appeal" of technology is a major factor in the decision process [2].

Full-motion video has the highest pheromone factor for those new to teleconferencing because it is impressive, and they believe that clients may find it so as well [2]. Most often the explicit objective stated is to reduce travel costs or save time. Coincidentally, these are also the benefits most frequently cited.

Problem definition is a key issue in the analysis of feasibility and for system design. If the problem is defined too narrowly (e.g., what kind of word processing do we need?), it will prevent certain alternatives from being considered (e.g., staffing, organizational, or procedural changes), which may be more valuable than narrowly defined solutions. On the other hand, if the problem is left too broad (how do we improve productivity?), it may prove unmanageable. Also, too often organizations begin with what is actually a solution (how do we implement video conferencing?) rather than identifying the problem that needs to be addressed. Many companies begin to investigate teleconferencing in response to a specific problem: increased travel costs, reduced travel budgets, difficulties in co-ordinating remote sites, need for more communication, need for simultaneous dissemination of information, desire to save management wear and tear, or the desire to meet the requirements of a specific application.

A multidisciplinary team should be assigned responsibility. While partial approaches may yield short-term benefits, a systematic approach will likely serve an organization better in the long-term. Moreover, by assigning specific individuals responsibility, a focus is provided for system development, and there is greater likelihood of reaching an integrated, comprehensive solution. With teleconferencing, fewer resources may be required; nevertheless, the principles still apply.

Finally, definition of specific objectives, policies, and constraints is desirable. Ideally, objectives should be measurable, because the more concrete and clear the statement, the easier it is to proceed with the feasibility assessment. Teleconferencing objectives can be expressed either in terms of displacement of costs or added value. Often, however, stated objectives do not address hidden agenda items, such as demands for profile or leadership, individual preferences, or corporate culture. From a purely rational standpoint, one would assume that the objective of any given system should be to maximize benefits within certain constraints: technical, economic, financial, organizational, or psychological.

2.2/ Identifying the Alternatives

There is no consistency in the way organizations identify alternatives: some consider only one form of teleconferencing, others begin with video and work back, and a few begin with simple systems and expand.

Many prospective users consider only one form of teleconferencing: Tandem is one of the companies that admit outright that no systematic approach to design was taken. They installed 17 video rooms after experiencing only three ad hoc video conferences, and without a formal study,

because top management wanted it; there is also no formal training for users [3]. Nevertheless, the system appears to be used frequently. Senior management at the Royal Bank of Canada also initiated the investigation of video teleconferencing and supported its implementation without investigating other technologies [4].

Typically, companies begin at the high end and work down, rather than vice versa. Many strategies begin with an analysis of travel patterns and meeting characteristics and then assesses the need for video teleconferencing. Where video is not required, audio will be considered [5].

There are, however, examples of organizations which began by investigating full-motion video but concluded that it was not feasible and accepted simpler solutions. As Elton notes, "Paradoxically, it was the advent of more glamorous (video) teleconferencing which stimulated interest in cost-effective options" [6]. The Bank of Montreal [7] and United Bank of Colorado [8] began by exploring the possibility of full-motion video but installed audio instead. Ford Motor Company also began with full-motion but concluded that "the operating costs to implement a system like that would have been horrendous" [9]. As a result, the company installed colour freeze-frame.

If the objective of the exercise is to solve a problem rather than impose a solution, a broad range of alternatives should be evaluated, including any non-technical solutions: travel restrictions may prove more effective in reducing travel than teleconferencing, though they may also hamper effectiveness. In all cases, "doing nothing" is an option to be seriously evaluated. Within the technology, a wide range of options exist and ought to be considered: audio, enhanced audio, computer, freeze-frame, and full-motion video conferencing.

From a rational or economic standpoint, "any communication as maximized at its simplest effective level" to convey a complex message through a simple medium is more effective [10]. Despite popular conceptions, audio teleconferencing, with certain enhancements, has proved to be adequate for most meetings. Audio alone is the least expensive, most flexible, and widely available form -- anyone with a telephone can participate. Most organizations use it to some extent. While most meetings do require some form of visual support, primarily typed sheets and vugraphs (Figure 1), the simplest way to provide this is by mailing materials in advance. Where this is impractical, electronic means can be used. Telecopiers or various forms of electronic mail transmit text, telewriters can exchange graphics or drawings, and freeze-frame video can transmit still images over the regular telephone network.

Where there is the need to see movement, expressions, or demonstrations, full-motion or compressed video may be appropriate. Most research indicates that these are required for about 10% of meetings, where negotiating, bargaining, or complex interpersonal tasks are involved; where a strong personal presence is required; or where "body language" and nonverbal clues are essential. At the present time, however, this technology is extremely expensive compared to audio teleconferencing support

with still images, text, and graphics (Figure 2) and limited in availability. However, despite the extreme cost compared to the marginal benefits, there is a marked discrepancy between needs and perceived wants: full-motion video is still the mode first considered and often the only mode considered by executives.

Many studies support the notion that simpler technology can satisfy a wide range of requirements. Internal evaluations at IBM, Ford, and Exxon determined that freeze-frame was sufficient for 80% of their applications [11]. In one of the few comparative studies which have been published, analysts from Fujitsu Ltd. reported results of concurrently run audiographic and full-motion video trials [12]. Although satisfaction with full-motion video was higher (38% rated it 5, 42% rated it 4, while 58% rated the audiographic system 4 on a scale of 1-5), they concluded that the audiographic system was more cost effective. When avoided travel costs were subtracted from teleconferencing costs, the audio-graphic system saved 1500 thousand yen per month. However, when avoided travel costs were subtracted from full-motion video system costs, the system still cost 4500 thousand yen per month. Clearly, the marginal improvement in satisfaction was not worth the extra cost. Other research has confirmed that full-motion video users tend to be more satisfied than audio users (8.25 vs. 7.7 on a scale of 1-10), but video costs are 20 times higher than those for audio.

The capabilities and costs of each form of teleconferencing should be considered in the feasibility analysis (Table 1). In some cases, the potential benefits will differ, depending on the organization's requirements. In many cases, a $5000 system may fulfil 50% of the requirements, whereas a $500 000 system will provide only 75%. Often there are diminishing returns, but in the final analysis, the technology must be evaluated in light of the organization's requirements.

3/ FEASIBILITY ANALYSIS

Various approaches have been taken to assess the feasibility of teleconferencing, with evaluation of the costs and benefits, both quantifiable and qualitative, most frequently used to develop a business case.

Teleconferencing is usually first considered as a means of reducing travel. Studies have suggested that up to 74% of conventional meetings could be teleconferenced, most of them using relatively simple and inexpensive technology. Many users have quantified significant travel avoidance using the technology:

- Boeing estimated that almost one million miles of local travel were avoided over two and one-half years with video conferencing [13].
- Control Data used audio conferencing to reduce its travel budgets by 10% [14].
- Ontario's Ministry of Transportation and Communications estimates $50 000 in travel was replaced over an 18-month period [15].
- Hercules credits teleconferencing and "better management" with a 22% reduction in travel, valued at 1.5 million dollars [16].

- Bell Canada estimates its in-house audio freeze-frame system saves about $180 000 per year [17].

The list goes on: IBM [18], Hughes Aircraft [19], Liberty Mutual [20], Deere and Company [21], Corning Glass [22], Westinghouse [23], Firestone [24], and the American Health Care Administration [25] are only a few of the organizations whose initial rationale for teleconferencing was to reduce travel.

Skeptics argue that while many organizations use this rationale, few have demonstrated that travel is actually reduced with teleconferencing, though they do quantify travel avoidance, that is, travel that would have taken place had teleconferencing not been available. Still there are a number of users who emphatically insist that teleconferencing did reduce travel; others, of course, report that it did not.

While the travel savings are significant, most organizations emphasize that the time savings are even more important. Meetings absorb more time for professionals and managers than any other single activity (Table 2). Teleconferencing, with its potential to reduce the time spent in meetings and in travel to meetings, can significantly improve productivity. Usually the cost of time spent travelling is estimated and used as a surrogate measure of teleconferencing's potential impact on productivity. The Ministry of Transportation and Communications estimated that over 2000 person hours of travel were avoided, not to mention the wear and tear on employees. Time savings also stem from the increased efficiency of teleconferenced meetings. Because they are usually better organized and more tightly controlled than face-to-face meetings, teleconferences often take about two-thirds the time of regular meetings.

In addition to the savings, users emphasize the importance of value-added benefits. Teleconferencing can improve communication, allowing meetings to be held more frequently and as the need arises. The time which lapses between the need for a meeting and the scheduling of the meeting is reduced. Although the impact of teleconferencing on "information float" cannot easily be measured, many argue that the timeliness of decisions is improved. Another benefit frequently reported is that teleconferencing allows more people to participate. Prior to the introduction of teleconferencing at the Ministry of Transportation and Communications, only one or two people from regional offices could attend head office meetings because of the travel involved. With teleconferencing, more regional staff could participate. Also, rather than merely briefing senior staff before the meeting, specialists can be brought in to address specific agenda items.

Interestingly enough, the benefits cited by users do not vary significantly with the technology. Ontario companies using mainly audio teleconferencing reported similar benefits to American companies using a variety of media: time and cost savings, improved efficiency, and increased participation [10] (Table 3).

Disadvantages cited tend to be more related to the medium employed. Users of audio conferencing often cite loss of face-to-face contact as the chief disadvantage. Users of video conferencing, on the other hand, tend to cite costs.

Another point of contention with respect to cost/benefit analysis is which costs are appropriate to include. For example, in addition to teleconferencing hardware costs, there are staff costs associated with operating the equipment, training users, or administration for the system.

A number of organizations use break-even analysis to justify teleconferencing costs. For the proposed system, the costs of teleconferencing are compared to the costs of travel to determine the level of usage required to justify installation of the system. If usage is expected to exceed this level, the system is justified. Usually the costs of teleconferencing are calculated based on the transmission, operating, and amortized capital costs. Naturally, various assumptions can be made to obtain the conclusions desired. For example, the break-even for the Ministry of Transportation and Communications was based on amortization of equipment over 12 years and included calculations of soft travel costs but not soft teleconferencing costs. Without soft costs, they needed four conferences per month, involving six locations where one person would have travelled from each site; with soft costs they needed three [15]. The basis of IBM's analysis is not clear, but they need approximately 12 meetings per month, involving two people that would have travelled [18]. Corning Glass estimated break-even for its freeze-frame system at 5% utilization [22]. Boeing estimated break-even for their full-motion video system at 15% utilization, but the specific assumptions which were made are not known [26]. Because the hourly costs of video conferencing transmission approximate the costs of return air fare, excluding other line and equipment costs, break-even cannot be achieved if only one person's travel is displaced or if meetings last more than one hour.

Other organizations have reported that teleconferencing is expected to displace a certain portion of travel, but the source of the expectations is never made clear. Atlantic Richfield (ARCO), for example, expected to reduce its travel budget by 20%, from 50 to 40 million dollars [27](the system actually cost 17 million dollars) [28]. This level of reduction is often cited in the theoretical literature, and it is possible that the reason it was chosen by ARCO was that it was the level required to justify their investment: they may have simply converted their teleconferencing costs into travel dollars. ARCO began investigating video conferencing in 1980, supported by the chief executive officer. One assumes that costs were not really an issue; the company spent over one-half a million dollars per site to provide "a system that was well patronized by ARCO employees" [27]. Likewise, the objectives of the Digital Equipment full-motion video pilot had no constraints, though it was estimated that the system would pay off in 18 months if it were used 80% of the time [29].

These approaches are conceptually simple and useful in obtaining senior management support. Most financial analysts would prefer other forms of

investment analysis, such as net present value. Cost justification tends to be used selectively, too often simply to rationalize a particular route. Financial analysis could be a valuable technique for comparing and contrasting different options, but most often it is used only to compare one form of teleconferencing with travel.

Many of the benefits of teleconferencing are intangible. While a reduction in travel costs may result in increased efficiency (that is, fewer inputs for the same outputs), there is no generally accepted theory of measuring increased effectiveness, even though this benefit is often cited by teleconferencing users. Many are adamant that intangibles are the only benefits to consider in justifying teleconferencing. Ontario's Ministry of Government Services, for example, defends its full-motion video system on the basis of its capability to enhance provision of services to Northern Ontario and argues that a dollar value simply cannot be assigned to these benefits. The introduction of teleconferencing has been compared to the introduction of computers. IBM included value-added benefits in its analysis. Teleconferencing, it was felt, would solve a number of problems, such as excessive time spent on repetitive activities, lack of timely reports, inefficient information gathering, inadequate information flow to customers, and revenues and time lost in the negotiating process. However, there is no evidence of any effort to assign a cost to these problems. Satellite Business Systems (SBS) has attempted to quantify "information float" by comparing the time when a meeting was necessary with the time when it could actually be held [30].

There is no question that cost justification is often developed after a decision has been made, using rationalization rather than objective analysis, enthusiasm for teleconferencing muddying the analysis. While it has not been conclusively demonstrated, proponents of full-motion video, the most costly form of teleconferencing, appear to be most reluctant to grant validity to cost justification. This may be because most full-motion video systems simply cannot be cost justified, particularly when compared to cheaper and simpler alternatives. IBM Canada did use break-even analysis to justify installation of a pilot project but never exceeded the break-even. Eventually the system was replaced with a cheaper more flexible freeze-frame system. Bill Dinwoody, in describing Canada's only other private, corporate, full-motion video system, owned by the Royal Bank of Canada, stated:

> First it must be acknowledged that accurate, tangible, cost justification of video teleconferencing is difficult to determine prior to its purchase and installation. The true value is recognized primarily after its installation and subsequent usage... our Executive already recognized the merits and potential of this service, had been exposed to it in the US, and requested that an evaluation be undertaken to determine costs. [4]

In other words, they wanted it. Alternatives were not considered. In contrast, although Bank of Montreal executives requested a study of video conferencing, including a survey of users of IBM's system, it was concluded that video conferencing did not add much to their particular

application of teleconferencing. The costs exceeded the benefits even when soft ones were considered [7]. As a result, executives were persuaded to try audio conferencing plus facsimile, with which they are very pleased. This example is, however, unusual. Often video conferencing is evaluated, and no alternatives are considered.

A sophisticated methodology has been developed by SBS to determine the feasibility of teleconferencing and project volume of use. Information on travel is screened to identify trips made, within the USA, to attend meetings at locations that have access to teleconferencing systems that would satisfy the meeting requirements. Using this information, it is possible to estimate the potential value of a proposed system. The questionnaire was administered to three large corporations, and the results are very interesting, but as the researchers acknowledge, few organizations have the time or resources required to undertake such a study [31].

3.1/ Feasibility Analysis

While economic feasibility is relatively simple conceptually -- the expected benefits must exceed or equal the expected costs -- it is difficult to apply. Neither the costs nor the benefits can always be calculated with certainty. As a rule, the costs of teleconferencing systems are probably simpler to calculate than the costs of information systems, because software development and staff costs (the two greatest uncertainties) are relatively insignificant. More difficulty lies in attempting to assess the value of benefits, as these are affected by the extent of use and acceptance. Moreover, while it is relatively simple to assign a dollar value to travel cost reduction, it is more difficult to quantify "improved productivity" or "increased responsiveness." Again, it is important to evaluate the range of technologies. From an economic standpoint, designers should begin with simple technologies and progress to more complex ones. One group of researchers has postulated a method for comparing systems, using two equations: "Teleconferencing System Effectiveness = Performance/Costs" and "Probability of Success = Satisfaction/Costs" [32]. However, they offer little insight into how the parts of the equation are to be measured and, to this writer's knowledge, none has seriously attempted to apply it. Once the economic cost and benefits have been estimated, financial feasibility can be evaluated according to the organization's preferred method (net present value, present value, return on investment, rate of return, pay back, etc.) [33].

Organizational feasibility is another dimension of the problem which cannot be ignored nor easily measured. Analysts must determine whether alternatives are likely to obtain the support and commitment necessary to ensure that benefits are obtained. It is generally felt that even the best designed systems can fail if senior management support is lacking or if users do not accept them.

Technological feasibility is another consideration. The limitations of various forms of teleconferencing have been identified but what the future holds is by no means certain.

Finally, there may be additional external and internal constraints to consider, such as time.

3.2/ The Feasibility Decision

The feasibility decision will involve subjective as well as objective assessment. While various approaches are possible, decisions should be made about evaluation criteria, weights, and rankings. Some alternatives may meet all objectives but exceed the constraints proposed. In many cases, no solution will meet all requirements, and decisions will be made about trade-offs. While the analyst or study team may present certain recommendations, the final decision is usually made by senior management (especially where substantial investments are involved).

3.3/ Determining System Requirements

3.3.1/ Introduction

While the study team must review user requirements at a basic level and make some assumptions to evaluate the feasibility of teleconferencing, detailed assessment of user needs must follow to develop detailed system specifications. In defining requirements, some argue that a comprehensive, long-range plan should be developed first to ensure integration. Others maintain that the technology is changing so rapidly that such plans are outdated before they can be implemented and insist that too much planning postpones achievement of the benefits. This debate is particularly fierce with respect to personal computers. This is also true of teleconferencing: an effort can be made to design a total, comprehensive system for the organization as a whole or to allow the development of smaller subsystems. There are trade-offs: comprehensive approaches, while more efficient, may take excessively long, whereas piecemeal approaches may lead to compatibility problems (though these are usually less severe than with information systems).

The importance of defining user needs cannot be overemphasized. However, there are different approaches to defining these needs: some advocate use of formal needs assessment, using a variety of research tools; others support the notion of using pilot projects to clarify requirements. However, as with feasibility studies, it is possible to use these tools to justify foregone conclusions rather than provide true insight. Theoretically, a successful teleconferencing system will be user-driven rather than technology-driven. No system, however "state-of-the-art," will succeed unless it fulfils certain requirements. In contrast, there are many examples of users struggling with antiquated and inadequate technology because it fulfilled some of their requirements. Needs assessment should reveal the functional requirements that must be met by the technical and administrative systems.

3.3.2/ Needs Assessment

A range of techniques can be used to collect information about needs, including literature search, interviews, meetings, study organization

plans, and accurately defined systems. Teleconferencing analysts examine existing meeting patterns, needs for more communication, and attitudes to teleconferencing and travel. In this way, requirements can be defined and implementation issues identified.

Many organizations have undertaken formal surveys to identify key travel and communication linkages, to analyse meeting behaviour and requirements, and to investigate attitudes to travel and teleconferencing. The Ontario Ministry of Transportation and Communications, for example, randomly selected 25% of its travel records to identify the principal travel routes within the organization. The analysis revealed that 30% was between head and regional offices, while the rest was diffuse, throughout the province. As a result, they elected to install dedicated facilities in some locations and use more flexible systems in others. Honeywell also began their system design with a survey of travel patterns. However, it is possible to obtain similar, though less reliable information, through discussions or interviews with key people. In many cases, the increased reliability of quantitative analysis may not justify the time or expense involved.

The next step which is often taken is the analysis of meeting behaviour, forms of communication, and the supports used in conventional meetings. The extent to which the meetings are for information exchange or simple reporting, as opposed to for bargaining or negotiations, will determine which technologies are required. Likewise, the use of materials that can be distributed in advance (overheads, reports, etc.) versus those which are interactive in nature (blackboards, white boards, etc.) will affect requirements. One survey indicated that the most commonly used aids were reports and vugraphs. Finally, the nature of communication flows may be important: meetings where one individual does most of the talking in a presentation mode require different capabilities than do highly interactive discussions.

Interviews with key personnel can also be used to identify groups and individuals in the organization which travel extensively to meetings. Because frequent travellers are usually more receptive than occasional travellers to the concept of teleconferencing, the needs of this group may be an important consideration in system design. While the requirements of the entire organization must be considered if the system is to be unified, many have, in fact, been developed to meet the requirements, initially, of a very specific group. For instance, both the Royal Bank and Bank of Montreal systems were designed for senior management. (As a result, this group tends to be the principal user.)

Finally, many organizations attempt to assess attitudes to teleconferencing and travel among prospective users. The results can be surprising: at the Ministry of Transportation and Communications, its 1978 survey revealed that most people were happy with the amount of travel that they did: only 9% wanted less; 21% wanted more [34]. The SBS survey revealed a similar pattern several years later: while 12% wanted to reduce their travel, 15% wanted to increase it [31]. As a result of these findings, both organizations concluded that even if travel

reduction is the objective of the organization, it may not be the best selling point to use in promotion.

The following guidelines for office work-station needs assessment apply equally well to teleconferencing [35]:

1/ Needs assessment ought to have a task focus rather than a technology focus.

2/ Change will occur in an incremental, dynamic, and often irrational manner. A decision maker, therefore, must plan a system that will accommodate the present work structure, but also one that will be flexible enough to allow for additions and changes as the users learn the system and the technology evolves.

3/ The techniques should be capable of providing input to decisions about design or equipment selections, because information about user needs can make important contributions at these early stages.

4/ Needs assessment should be developed with great care in defining what capabilities are to be considered. It is too early in the evolution of such systems to draw narrow system definitions.

5/ An assessment should be structured to avoid "false positives" that could result in a system that is either bypassed or is greatly under-used by the people for whom it was intended.

6/ Needs assessment requires information about the culture of a user group, as well as its mission, organizational structure, and other key aspects of its operation. Multiple perspectives will be necessary.

7/ The methodology should allow for input that is quantitative as well as qualitative, rational as well as intuitive. When making complex judgements, people are often able to provide useful intuitive and qualitative reactions before they can give accurate quantitative responses.

8/ The assessor should be aware that there will be a tendency to find needs, even if they do not exist.

Where formal surveys are not appropriate, user-needs workshops may prove useful. Similar in concept to the focus groups frequently used in market research, the workshops were designed both to educate users and collect information.

3.3.3/ Developmental Approaches

Opponents of formal needs assessment argue that the requirements for new technology cannot be assessed without providing hands-on experience. There is, however, no well-articulated approach to pilot projects, though many organizations have taken this route. Test beds may be conducted with prototypes or with off-the-shelf equipment, running one trial or

several simultaneously. A variety of techniques can be used to monitor the results. Formal evaluation is essential: criteria must be established at the outset, objectives should be clearly stated, and a set time frame should be agreed upon. The design of the trial can all too easily influence its outcomes. A key decision is the length of the trial: a complex product requires a long period of adaptation; on the other hand, testing itself may generate more enthusiasm than can be sustained beyond the "honeymoon period." The selection of users is critical. The results will be more meaningful if users carry out real tasks rather than simulated ones. Finally, handholding and troubleshooting are important during the start-up phase.

Pilot projects are appealing for a number of reasons. A well-designed pilot will have defined objectives and discrete parameters, thereby reducing risk and uncertainty. It will be easier to implement, control, and evaluate than a full-scale project. However, benefits are likely to be reduced because of limitations in terms of applications, capability, flexibility, and accessibility. Moreover, without clear objectives, evaluation criteria, and time frame, pilot projects can develop a life of their own, evolving into operational systems because no one would admit failure, especially after substantial investments had been made. Conversely, there is the risk that a pilot failed not because it was badly conceived but because it was poorly executed or designed. There is always some danger that pilots can be manipulated to certain ends.

Many organizations have adopted an evolutionary approach to teleconferencing, beginning with small-scale pilots and expanding capabilities on the basis of experience. This is particularly useful where applications are not well understood. IBM, DEC, and the Government of Ontario adopted this approach. IBM is one of the few organizations to abandon a full-motion pilot that worked reasonably well, because it did not meet its objectives. Again the rationale for proceeding with a particular technology should be clear: a full-motion video pilot may prove successful where an audio pilot would also have succeeded. For example, Control Data had a successful audio project in place when it ran a freeze-frame video trial. It decided to abandon freeze-frame, concluding that "in most cases they could convey the same information using audio only." Had they had no previous experience with teleconferencing, the result might have been different.

4/ ENDNOTES

[1]Some of the material used in this chapter was developed as part of a research project by W.L. Cukier under the supervision of Dr. W.L. McCandless of the Faculty of Management Studies at the University of Toronto.

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Table 1/ Cost Comparison: Toronto to Montreal

	EQUIPMENT	COST PER LOCATION (AMORTIZED)[1]	VARIABLE COSTS (yr)[2]
AUDIO	Speakerphone	$200 ($40/yr)	$40/hr (9600/yr)
	Conference 2000/ Convener	$1500 ($300/yr)	$40/hr (9600/yr)
40% Applications (conservative)	Custom Design	$15 000	$40/hr (9600/yr)
ENHANCEMENTS[3]	Facsimile	$10 000 ($2000/yr)	$40/hr (9600/yr)
	Electronic Blackboard	$15 000 ($3000/yr)	$40/hr (9600/yr)
FREEZE-FRAME[3]	Low quality	$15 000 ($3000/yr)	$40/hr (9600/yr)
68% Applications	High quality	$70 000 ($14 000/yr)	$40/hr (9600/yr)
FULL-MOTION	Portable (pre-emptible)	$25 000 ($5000/yr)	$225/hr + lines[4] (66 000/yr)
78% Applications	Custom Designed (pre-emptible)	$250 000 ($50 000/yr)	$225/hr + lines[4] (66 000/yr)
	Custom-Designed Satellite	$250 000 ($50 000/yr)	$1300/hr (312 000/yr)

[1] over 5 years
[2] assume 240 hours of use
[3] assume must add audio to freeze-frame and enhancements' cost
[4] usually $1000 or more per month

Table 2/ Characteristics of Office Workers [39]

TASK	MANAGEMENT	PROFESSIONAL
READING AND SEARCHING	25%	15%
FORMAL MEETING	23%	11%
2-PERSON MEETING	18%	27%
TELEPHONE CALLS	12%	5%
TRAVELLING	11%	10%
WRITING	5%	7%
TYPING	-	4%
WAITING	-	5%
APPROXIMATE LABOUR COST	26%	40%

Table 3/ Attitudes of Users [40]

ADVANTAGES	
SAVES TIME	46%
SAVES MONEY	22%
IMPROVES EFFICIENCY	7%
INCREASES PARTICIPATION	12%
DON'T KNOW	13%
DISADVANTAGES	
NONE	35%
LOSS OF FACE-TO-FACE CONTACT	15%
EXPENSE	12%
EQUIPMENT PROBLEMS	6%
ARRANGING SCHEDULES	5%
DON'T KNOW	21%

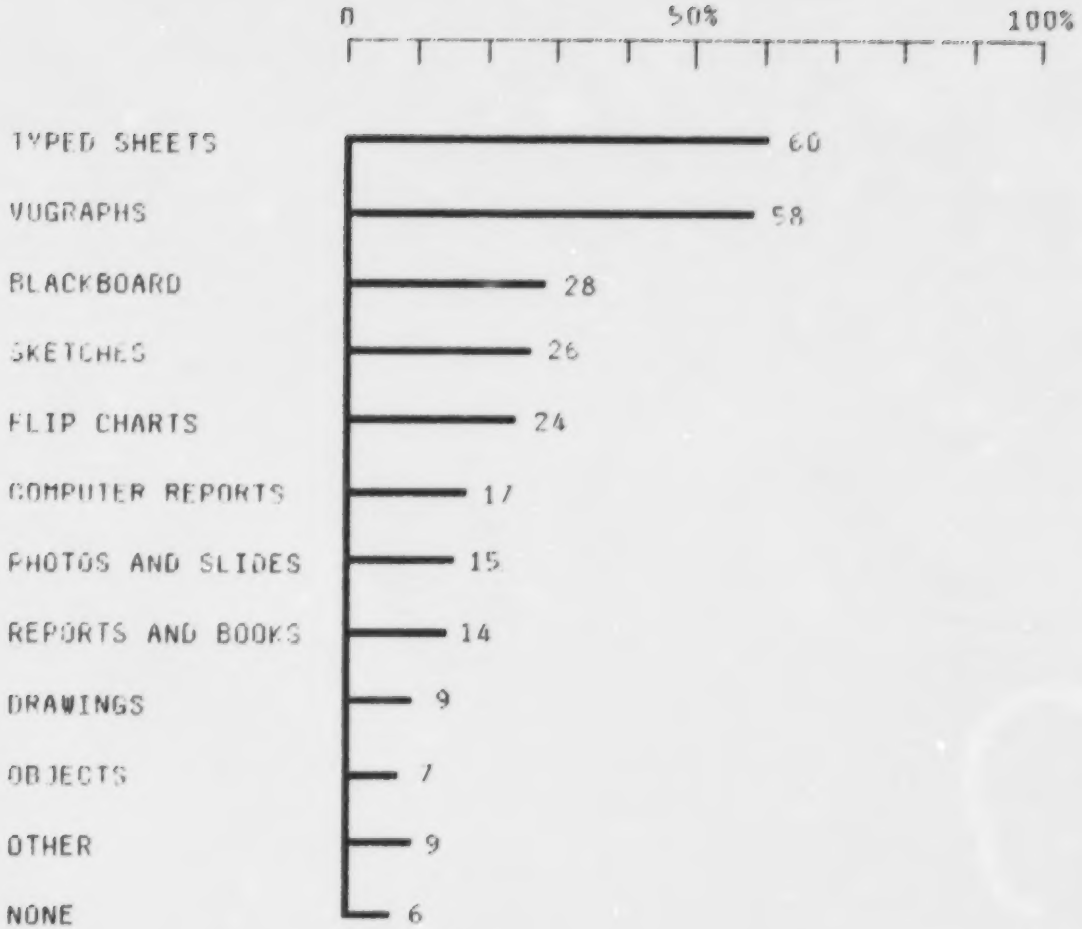

Figure 1/ Meeting Requirements [41]

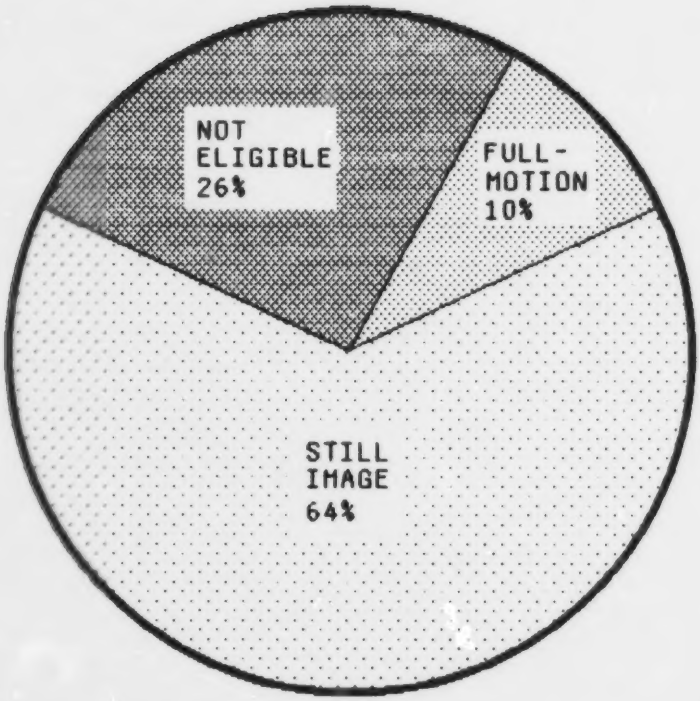

Figure 2/ Substitutability of Meetings [41]

PART 4/

HUMAN FACTORS IN TELECONFERENCING

1/ INTRODUCTION

To ensure the successful implementation of teleconferencing in any organization, consideration must be given to the area of human factors. People will not use a technology simply because it is a good idea or will save them time and money; the technical structure and human interface must be both initially and lastingly rewarding [1]. Discussion of the human factors involved in teleconferencing must, therefore, take into account both the relationship of a user to the technology and the users to one another as they interact with the technology. At the base of the question lies not only the user's attitude and behaviour towards the hardware, but also the problem of successful interpersonal communication in situations where technology is, at least in part, a means of conveying that communication.

Attention paid to human factors in the system development and throughout the stages of implementation and use will help to ensure that, once in place, teleconferencing becomes a regular and accepted part of business management, education/training, or health care.

2/ ERGONOMICS: USERS AND THE SYSTEM

Developing an effective teleconferencing system means more than buying the best equipment available. The equipment must meet the users' needs. When considering teleconferencing for an organization, user needs must be carefully assessed before the ergonomics/human factors in system development can be considered. People will not use what they do not need, and conflicts are less likely to arise if potential users are involved from the beginning. The rejection of a system as unnecessary may simply reflect hostility because the system was forced on the users without sufficient attention paid to their needs and, more importantly, their fears and apprehensions. A pre-system design or selection may focus primarily on needs assessment for meeting tasks or objectives. Ergonomics must also take into consideration the psychological needs of the users; failing to meet these can often be more detrimental to sustained use than failure to include pieces of hardware necessary for task completion.

"User friendly" has become the buzz word in ergonomics, and although it is becoming somewhat trite and overworked, the phrase points to the essential in any efficient system. However complex the subject of human factors in system design, the objectives are clear: to create a system that meets the needs of the teleconferencers and is easy for them to use. In some cases there may have to be compromises: different user groups may have conflicting needs, perceived needs may clash with available budget, and suitable technology may not be currently available. Nonetheless, a balance must be struck to ensure continued and profitable use of the system.

The human factors of system design come into play once the needs assessment has been completed. "User friendly" forms a bridge from the fulfilment of needs to the human response of positive continued use. Even

if it fulfils a need, the technology may not be used if it proves difficult or frustrating.

The considerations involved in ergonomics can be grouped under three headings: location, comfort, and operation.

Location -- In most organizations, territory is well defined. In locating teleconferencing equipment or rooms, neutral territory is best unless the system is to be used by a select group. Junior personnel may be reluctant to invade executive territory or, vice versa, to hold a teleconference. Where audio-only is involved, terminals available in more than one location may alleviate anxieties. The arrangement or placing of equipment and furniture may seem to be a minor consideration, but in video conferencing, where visual impressions are important, the relationship of participants to each other and to the cameras, monitors, and visual displays may be crucial.

Comfort -- In promoting the regular use of teleconferencing, it is important to make the activity as natural as possible. Although some persons are stimulated by new or unknown adventures, many prefer the known and familiar. Selecting room design, furnishings, equipment, etc., for comfort is very important when promoting a new concept or way of doing business. In audio teleconferencing, particularly, comfort factors may be needed to compensate for the lack of face-to-face contact. (Teleconferencing, however, can be, and has been done, under conditions with no comfort factors.) The areas of comfort factors to consider are furniture; table surface (particularly if there will be controls, microphones, etc., on it); legibility of graphics or pictures on the monitors or boards, both the size and colour contrast; and the audibility of the audio. Straining to hear or understand disembodied voices may be more tiring or frustrating than many are willing to put up with. High-quality audio will be essential for most teleconferencing. Security or privacy features should be based on user needs, and information on such features should be available. Anxiety about the degree of security or privacy available may cause unnecessary discomfort and rejection of the system. Further comfort factors to take into consideration include coffee breaks or available refreshments built into long meetings and understood by all locations. (It is disturbing to address a question to a participant in another location only to find that he/she has stepped out for coffee; it is equally disturbing not to be able to step out for a coffee for fear of being rude.) The overall atmosphere -- temperature, ventilation, appearance -- of the room may also be important.

Operation -- The equipment should be easy, or comfortable, enough to use that it becomes transparent and the participants are scarcely aware that it is there. Control buttons should be within automatic reach and used with little thought after the initial instructions. If a sequence of steps is involved, it should be simple and quick to master. If more complex systems are employed, the equipment must be set up for each use; the handling of such functions by a technician or teleconferencing co-ordinator reduces anxiety. Systems should be as "error proofed" as possible. No one wants to look like a fool in a meeting by making a

simple mistake and causing a disaster. No system, however, can be completely without the potential for problems. Just as a face-to-face meeting can default due to traffic snags, weather conditions, or human emergencies, teleconferences can run into faulty lines, pre-emptions, malfunctioning equipment, or untrained users. Most problems can be anticipated and checked in advance; others must be dealt with at the time, and instructions for the participants, or staff, should be available to handle such situations.

One further factor which can be important in ergonomics as well as in the area of interpersonal communications is that of perceived role conflict or role uncertainty. Specific aspects of the system, such as the shape of the table, size of the monitor and incoming video image, the type of microphone, the presence of a technician to handle the controls, and computer access, may have to be carefully selected or designed so as not to threaten or violate a user's position.

3/ INTERPERSONAL COMMUNICATIONS: USING THE SYSTEM TO FACILITATE, NOT IMPEDE COMMUNICATIONS

If a system is designed to meet the users' needs and takes into consideration the factors of location, comfort, and ease of operation, then half the problem of human factors in teleconferencing is met -- but only half. The users will be able to interact easily and successfully with the technology but not necessarily with each other.

Successful teleconferencing requires that consideration be given to the ways in which people relate to each other to accomplish their stated objectives. This dimension of human factors covers three areas: promotion (getting them to try it), administration (supporting their efforts), and training (keeping them using it successfully). Beyond these are a number of deeper issues that trainers and implementers need to keep in mind to promote and train most effectively.

3.1/ Administration

From the standpoint of human factors, the administrative system is the solid support behind promotion and training. The success of a teleconferencing program depends, in large part, on its supporting administrative framework. This includes personnel, procedures, and monitoring and evaluation.

Personnel -- Most successful programs have a co-ordinator to manage the design and implementation of the system and oversee maintenance and promotion. With teleconferencing, local co-ordinators may be needed to schedule conferences, oversee equipment setup and operation, train users, assist in monitoring and evaluation, promote the use of and disseminate information about teleconferencing, and generally handle the day-to-day operations connected with the program. Often each point on a network will require a local co-ordinator to provide liaison between the system's users and the program co-ordinator. His/her duties may include

- booking the system and maintaining records of usage;
- setting up equipment, dealing with minor problems, and notifying the central co-ordinator if more serious difficulties arise;
- participating in user training sessions and providing assistance to users, as needed;
- ensuring evaluation data are collected; and
- promoting teleconferencing by distributing information, answering questions, and encouraging people to use the system.

Procedures -- Typically, operational procedures are developed to ensure that the system runs smoothly. Guidelines are established concerning

- booking the system,
- handling technical difficulties quickly and efficiently,
- processing bills or charge-backs, and
- collecting data for evaluation or monitoring purposes.

The training of designated personnel to handle the booking of the system and equipment setup will go a long way to alleviate fears and frustrations of altered modes of business, possible role perceptions, or wasted executive time. The assurance that it takes as little time and effort to set up a teleconference as to set up an out-of-town meeting may induce some to try the new way. Similarly, knowing that the system will be properly set up, tested, and activated, and that any problems will be quickly taken care of by someone else, will reassure those who dislike, or are uncomfortable around, wires and technology that teleconferencing is nothing to worry about.

Monitoring and Evaluation -- A well-developed monitoring and evaluation program is needed to identify and rectify any problems which develop and to assess the relative success of the program. It will help determine how teleconferencing is being used, how well the equipment is working, the level of satisfaction, and the benefits of teleconferencing. In addition, specific components of the program, such as training sessions, can be assessed.

In many organizations (e.g., Honeywell, IBM Canada, and the Ontario Ministry of the Environment) [2] users complete self-administered questionnaires after each teleconference. Data collected include the number, names, and locations of participants; the purpose and length of the meeting; travel substitution; and level of satisfaction. Such continuing assessment provides information on the network of use, applications, satisfaction, costs, and benefits. It also can reveal problems, such as the need for more training or better procedures, and enable corrective action to be taken. While many people resist completing forms, follow-up by co-ordinators can ensure a good response rate.

In some cases, monitoring is supplemented with formal surveys to assess, in more detail, the effectiveness or limitations of teleconferencing.

Not only will monitoring ensure that the system, in general, fulfils the initially assessed needs and that problems are dealt with immediately,

but it will also reassure users that their individual problems, frustrations, or ideas will have an immediate vehicle for expression and that there is an overall process that will ensure smooth running of the entire teleconference.

3.2/ Promotion

Without proper orientation of potential users to its benefits, applications, and operation, even the most well-designed system may sit unused. Although promotion and training are separate aspects of an orientation program, they often overlap. The major problems which training and promotion address are

- lack of awareness and knowledge of teleconferencing,
- reluctance to reduce travel voluntarily,
- resistance to change, and
- technophobia.

Although there are four separate problems, they seldom occur in isolation, and promotional campaigns and training sessions will be designed to handle the problems as they interrelate.

The level of awareness of teleconferencing will vary within an organization, from those who have never heard of the concept, to others who lack sufficient knowledge of availability and use, to still others who lack confidence with the system. Likewise, attitudes to travel and receptiveness to change will differ: for many, travel is a perk, although this is less likely to be the case for those who travel regularly; for others, travel is not particularly pleasurable, but alternatives may not have occurred to them.

Most people are creatures of habit, and trying to change a person's traditional ways of doing business, whether it be organizational procedures or presentation style, can be the biggest challenge for an orientation program. At times, what appears to be a simple reluctance to change may, in fact, mask a fear of the new technology.

Because teleconferencing is a new way of operating, considerable internal marketing is often required to encourage initial and continuing use. Even in organizations where, of necessity, teleconferencing has been mandated, promotion is an essential companion to training.

Ideally, a successful promotional campaign will

- inform/remind of the nature and uses of teleconferencing,
- persuade that there are benefits for both the individual and the organization, and
- encourage the uninitiated to try it and users to continue.

There are several target audiences for a teleconferencing promotional program, including senior management, whose support helps ensure success; co-ordinators; and of course, prospective users. Presentation materials can be tailored to each audience.

A wide variety of promotional aids can be used:
- audiovisual presentations
- pamphlets
- posters
- open house demonstrations
- newsletters
- memos
- inserts with airline tickets

Many organizations, including Bell Canada, Exxon, and Honeywell, have developed sophisticated promotional programs to support their teleconferencing systems [2].

3.3/ Training

3.3.1/ Rationale: Why Train?

Although experts in the field of teleconferencing agree that training is important, if not essential, the extent, form, and delivery of training are far from unanimously defined [3,4,5]. In teleconferencing, training encompasses the teaching/learning of the technical skills needed to operate the system's hardware, as well as the information, attitudes, and skills required to guarantee that the meetings achieve their objectives.

3.3.2/ What Does Training Do?

Training addresses itself to three central issues: hidden threats, changing habits, and learning new skills.

Hidden Threats -- For many people, new situations, including the use of new technology, are perceived as stressful occasions and, consequently, resisted or avoided. Training sessions should present teleconferencing in a non-threatening way, by stressing the benefits, giving clear and precise instructions on the operation of the equipment, and showing the new situation as a challenge. Some fears that have to be confronted include
- fear of new technology and its operation, thereby making hands-on experience crucial;
- camera shyness in video conferencing or fear of being caught at inappropriate moments in freeze-frame; and
- concern about not being heard or being left out of the discussion in audio-only teleconferences, which can be remedied by training the chairperson in the techniques of meeting organization and polling.

Changing Habits -- Although teleconferencing may have things in common with other forms of communications (telephone calls, face-to-face meetings, or in the case of full-motion, television), it is also a new means of communication and requires trainers with sensitivity and tact to advocate good meeting skills, skills which badly handled in face-to-face meetings can be compensated for, but in a teleconference may be distastrous. Old habits in the areas of preparation time, organization, and procedures for participation must be changed:

- Advance preparation of documents and agenda is advantageous to any meeting but vital to a teleconference.

- Organization of agenda items and presentation may make a normal meeting shorter and more smoothly run, but when a teleconference lacks organization and runs overtime, chaos can ensue. Time allotment is even more crucial in video conferencing, where transmission time is usually pre-booked.

- Spontaneous and free discussion may be an advantage to many face-to-face meetings but can also be the cause of frustration and annoyance in others when some parties dominate and others feel excluded. Undisciplined teleconferences can accentuate the feeling of exclusion or control by dominant parties, but ordered disciplined meetings with a strong chairman can effectively include all participants, reduce irrelevant talk, and speed up decision making.

For many people, the greatest problem will be learning to cope effectively without such old supports as body language, which is a valuable communication tool for indicating or perceiving reactions such as annoyance, consent, agreement, confusion, hesitation, caution, or trust. Without visual cues, some teleconferencers may feel uncertain about making accurate decisions. Even in video, the camera does not always focus on the particular individual a participant may wish to observe. Deliberate training, through practice and/or discussion, may be required to help users learn to articulate feelings or reactions and to rely more on voice tone, pitch, or murmurs. The absence of the visual presence can, at the same time, be an advantage to some by eliminating irrelevant prejudgements on the basis of physical appearance. Practice helps greatly, and especially when participants are known to each other, adjustments can be made without undue difficulty. If users are comfortable with each other, they may offer suggestions and criticisms, which can sometimes be more effective than when criticism comes from a trainer, as it is coming from peers in an atmosphere of support and encouragement.

Learning New Skills -- Leaving old habits behind, however, is not enough in teleconferencing: new ones must be adopted. In point-to-point video, these should be minimal; in point-to-multi-point, extensive preparation and coaching may be necessary to ensure success. With audio-only, new styles of presentation and organization are often required.

The importance of good listening skills for successful business meetings is increased in teleconferencing. Without visual cues and reinforcement, more demands are made on concentration and motivation. Trainers may discover that short sessions on effective listening could be valuable for teleconferences and other meetings as well.

To maintain concentration and involvement, particularly in audio teleconferencing, presentations will need to be organized to be interspersed more frequently with visual supports, change of speaker (e.g., pause for questions or comments), or change of tone or pace. Some trainers may find themselves involved in the instruction of visuals preparation, not

only for new technology, such as Telidon or freeze-frame video, but also for such older forms as slides and overheads for those who have avoided such aids in favour of the blackboard and flip charts. The latter are still valuable for full-motion video, but slides or transparencies, which can be duplicated and mailed to remote locations, are extremely useful for audio-only teleconferencing.

3.3.3/ The Training Program

Approach -- Attitudes towards teleconferencing as a communications medium will affect the approach taken in training. Is it regarded as a replacement for face-to-face meetings, as a new tool for doing business, or a combination of the two? Is the same attitude taken when looking at full-motion video or audio-only teleconferencing? In training, is the emphasis on compensation ("here is what you must do to make up for the lack of ...") or on the innovativeness ("here are the things you can do with this technology that you couldn't do without it")? Will the trainer's approach have any effect on the success of the training?

Meeting Types -- Training sessions must also take into consideration the type of meeting or situation involved. Teleconferences that involve the regular meeting of small numbers of persons who know each other well will often be more informal than larger meetings involving strangers. The former group may break all the rules of teleconferencing protocol without the disastrous results which could ensue if the latter group tried too much informality. Teletraining or educational teleconferencing, where a group who are initially strangers meet regularly over a period of time with specific learning objectives in mind, may need a different form of training. The learners may require little initial training except in the use of the equipment, with teleconferencing skills development built into the main learning itself. More intensive training will be required of the moderator/teacher.

Telehealth uses of teleconferencing include administrative or business, educational, diagnostic, and social therapeutic.[1] Training sessions should prepare users for all types or those applicable.

Quantity -- Since training involves the changing of behaviour and/or attitudes of persons who may vary widely in knowledge, aptitude, and interest, and teleconferencing itself involves systems ranging from the highly complex to the relatively simple, there can be no easy formula for the number of hours or minutes of preparation required for success. The length and number of the training session will also depend upon the intended application of teleconferencing and on whether the trainee is to act as a meeting chairperson or attendee, educator or student, or guest expert or observer. It is important for any trainer to understand the variables involved and steer a course somewhere between extensive training, which makes teleconferencing appear so difficult that it scares away potential users, and so little preparation that participants are "winging it" and the meeting becomes a hit-and-miss experiment.

The type of teleconferencing system being used will also shape training requirements. Point-to-multi-point video may require the most specialized training, but only for the small number of presenters. Consultants in the business generally recommend scripts and rehearsals, as well as coaching in presentation style. Due to the limited number of participants and locations and to its most closely resembling a face-to-face meeting, point-to-point full-motion video should require the least amount of training. In most video studios, the system is either designed to be handled by a technician or is made as "user friendly" as possible, with training emphasizing the simple procedures for operation of the system, preparation and presentation of graphics and visuals, and camera awareness (e.g., colours to avoid wearing, positioning, and postures before the camera).

Since audio teleconferencing, with or without visual support, is the most flexible and, thereby, the most varied form, it presents the most concerns for trainers. Audio teleconferences will vary in size and number of locations involved. Some will make extensive use of equipment for visuals, whereas others will rely on mailed-in-advance reports or other documents. Training must always be flexible enough to accommodate all situations and possible personnel involved. Creating an environment in which people at different locations can comfortably and successfully interact with all other attendees, even though they cannot see them, is the main challenge of training for audio teleconferencing.

If teleconferencing involves the presentation of a body of information by an expert to a group of listeners with little emotional involvement, training will emphasize the organization of the material, presentation of visuals, incorporation of feedback and questions, and possibly, presentation style. For example, a person who relies heavily on body language and movement for dynamics in a meeting or classroom will have to learn news ways of presenting material. When intensive discussions or controversial material is involved, training will also emphasize the techniques for creating and controlling group interaction.

Form -- Most experts agree that hands-on demonstrations are the key to success in making the user feel comfortable with the new technology. Equally important is the inclusion of variety. Adults learn most effectively if they are allowed to choose the medium through which their learning takes place. Teleconferencing training, therefore, becomes a matter of more than a one-shot group session. For some, the relative anonymity of a group may be the best introduction to teleconferencing -- no immediate commitments, no forced trials. For others who like to experiment, a relatively small group or one-to-one meeting in an atmosphere of free trial and error may encourage the most interest. Some prefer to examine and study equipment and information by themselves. Slides or videotapes presented to a group and made available for individual viewing or small group discussion can be valuable training aids. Printed material should be available for those who like to study before or after a demonstration or hands-on session, who may have no opportunity for a practical dry run, who prefer self-study, or who may need ongoing reference tools.

Clear, concise instructions for the operation of the equipment should be found with or on the system. Quick tips or checklists for teleconferencing may also be kept with the equipment if the room is dedicated to teleconferencing.

Personal one-to-one sessions, as well as group sessions, should be available whenever possible. The range of options will depend upon a company's selection of trainers and whether or not training is to be in-house, external through a professional consultant, or a combination. In the early stages of developing a teleconferencing program, a company/organization may rely upon outside assistance: equipment suppliers, telephone company personnel, consultants, teleconferencing service providers, educational institutions, or others. Once teleconference equipment has been installed and a program established, in-house training can be most practical and effective. Professional seminars and conferences provide valuable ongoing training for co-ordinators or in-house trainers.

Training must be a continuing endeavour, not just a blitz when the equipment arrives or the system is installed. Personnel who come to teleconferencing after the system has been in use for some time should also have access to training.

Personnel -- In all types of teleconferencing meetings, the greatest emphasis in training must be placed on the chairperson/moderator/teacher. It is this person who exercises control, whether overt or covert, over the meeting and is responsible for seeing that the objectives are both known and met. Training a participant may involve only a briefing on which button to push for the microphone and a few protocols for interaction. Training a moderator will vary from simple instructions on equipment use, preparation of the agenda and materials, and protocols for keeping the meeting interactive but in order, to lengthy rehearsals or detailed course outlines. For a business meeting, the moderator's training should initially be as brief and succinct as possible without omitting essentials to good teleconferencing. Busy executives do not have time (unless especially interested) to learn complex techniques.

More in-depth sessions might become part of a workshop or teletraining course undertaken voluntarily by users or potential users who want to maximize their use of the system. Companies such as The Darome Connection and Bell Canada, in this country, and educational institutions such as the University of Wisconsin-Extension in the United States run regular training sessions for audio teleconferencing users. Moderators/teachers involved in teletraining or educational teleconferencing will need more training in course design for teleconferencing and the inclusion of techniques to ensure that the learning objectives are achieved.

The training of persons who are already successful classroom teachers may require, as it will with those who have been conducting successful face-to-face meetings, tact and understanding. Persons in such positions

may not initially perceive that there are new skills to be learned or assume that they can "pick them up" as they teleconference.

Perhaps the most extensive preparation of teleconferencing personnel will be that of the moderator in a point-to-multi-point or special-event video conferencing. Since these events resemble television broadcasts and the attendees are used to a high quality, precautions should be taken to ensure that presentations live up to expectations. Those experienced in special-event video [6] recommend hiring a consultant to assist with such necessary elements as scripting the presentation; developing voice, delivery style, and movements; and rehearsing the entire "show."

Individualized training will be required for on-site co-ordinators, whether for one-time events or more continuous teleconferencing. Depending upon the size of the operation, the duties of the on-site co-ordinator may be combined with administrative, promotional, or training functions. The co-ordinator will be responsible for maintaining the teleconferencing room and equipment, or setting up the system if it is portable; initiating the call, when requested; maintaining the system in good working order and troubleshooting when necessary, both before and during the meeting or session; and providing on-the-spot instructions on use of the equipment. Since the on-site co-ordinator may be the primary link between users and teleconferencing, he/she may also need to supply some of the humanizing element to the experience by doing everything possible to see that teleconferencing is perceived as easy to use (e.g., there are no problems with the equipment; instructions on use are simple and clear) and a natural way to do business (e.g., answering questions, providing information on protocols, and suggesting applications).

3.3.4/ Audiovisuals

Instruction in the development of correct audiovisual materials will form part of a good training session. The system available will dictate the appropriate visuals and, consequently, the type of instruction available. In situations where monitors are used to receive information, careful attention will be given to legibility and contrast when slides, charts, graphs, or pictures are prepared. New users of teleconferencing and audiovisuals may need guidance in how to incorporate visuals effectively into a presentation: how many to use; when to use them; how to relate spoken word to the material on the visuals; or in more complex situations, how to work with objects, medical graphics such as X-rays, or complicated engineering diagrams.

A few guiding questions to ask include the following:

- Will the figures or pictures be legible on the monitors at all locations?
- Is the layout simple enough to be understood at a glance (simple enough being relative to the particular audience)?
- Will the colours provide a strong contrast whether the monitor is colour or black and white?

- Do the graphics give additional information to what the voice is saying or do they repeat or contradict it, or even add an entirely new message?
- Is the introduction of the graphics well paced?
- Does this allow you to get your message via graph across quickly, eliminating boredom, or are you going too fast?

Whatever visuals are used must contribute to the achievement of the meeting objectives. In teleconferencing, good visuals can add clarity to spoken material or help to provide reinforcement often supplied by physical presence and body language, as well as a human touch, which may seem to be lacking in audio-only teleconferences.

Since many examples could be cited of successful teleconferences involving persons without training, it cannot be claimed that training is an absolute must for all teleconferencing. Studies undertaken to show the before and after effects of training would be costly, time-consuming, and involve so many variables as to make the results questionable. It is generally agreed, however, that teleconferencing has a greater chance of success if proper training is available to all users.

4/ ISSUES FOR FURTHER CONSIDERATION

For those persons who participate in teleconferences or even chair or moderate the meeting, many of the issues underlying human factors considerations will not be important. For system designers, trainers, and educators, the deeper issues may have more significant implications. The major issues of concern may be grouped under four broad headings:
1/ power and control
2/ body language
3/ energizing
4/ bonding and group cohesion[2]

4.1/ Power

Most of us access power relationships, which occur in all group meetings, affecting interpersonal dynamics, using various sources of data.[3] Most people like to be able to ascertain what those power relationships are and to convey their position to others. Teleconferencing, whether audio-only or video, removes or alters some of the data sources for assessing these relationships. Some, therefore, abandon teleconferencing. A moderator who is used to establishing leadership or control by sitting at the end of the table or front of the class may find that the scattered rooms of audio teleconferencing leave him/her searching for a new means to establish leadership. For others, the equalization of position may be a liberating experience and a greater reason to use the new medium. Power may be conveyed by rank and title, but choice of seating, physical appearance, body movements, voice, cultural conditioning (e.g., interrupting or waiting for a signal to speak), and other such actions all contribute to our conveyed sense of position. Physical proximity to other members of the group may convey messages of alliance or opposition. Even in video, where all participants are seen some of the time, most of

these sources of data are removed and trainers must help the teleconferencers to find other means of conveying the data (e.g., through voice, well-planned and well-conducted agenda, and content of contributions) employing the freedom which the absence of restraining power positions gives to complete the tasks at hand. New and exciting things may happen in a classroom when the teacher is freed from the "front of the room" role or a more junior staff member in a branch office can contribute without being self-conscious. However, retaining power and control may be the biggest worry for many potential teleconferencers -- but it will seldom be expressed so bluntly.

4.2/ Body Language

Closely allied with the expression of power and control is the issue of body language. So important has it become in our society that popular books have been written to help you understand what others are really saying to you.[4] For most, body language in a meeting is a subtle, almost unconscious way of conveying and receiving information. Teleconferencing training confronts the problem of trying to compensate for the absence of these subtle cues when we may not always be conscious of what we are conveying. And in this dilemma lies the success of teleconferencing.

Cues may be either consciously said or done (e.g., a raised hand or finger to indicate a desire to speak), or unconsciously done or unsaid (e.g., a spontaneous frown of disapproval or the absence of a nod of agreement or verbal affirmation). Body language may also be positive (in that it contributes to the completion of the meeting objectives) or negative (it is disruptive, sidetracking, or misleading). Body position, physical appearance, or gestures may in fact convey unintentional truths (what you really felt but wouldn't say publicly) or wrong information (your bad back or uncomfortable chair forces you to convey ideas of discomfort which may be interpreted as displeasure or disagreement).

Although many have commented that face-to-face meetings are necessary to establish rapport, few have pin-pointed the cues which are important in a face-to-face meeting as opposed to those which are irrelevant. Trainers can encourage teleconferencers to put their feelings and thoughts into words and to build more opportunity for interaction into the agenda. More investigation into the "essential" body cues may help trainers to develop strategies for compensation. For example, body cues essential in many situations are the nod of agreement or assent and the hand or finger gesture to indicate desire to speak. Many fear that not being seen means being forgotten and not being heard. Compensation for such cue absences must be built into the agenda or course design. For some, the freedom to move around the room while listening to the teleconference, without being assumed to be inattentive, may relieve cramped feelings which often result in squirms that can so easily be interpreted as boredom or rejection or ideas.

On the other hand, trainers/educators can capitalize on the absence of negative cues to help meetings focus on the objectives at hand. Content and presentation should become more important as people cannot be

evaluated in audio teleconferencing on their physical appearance. (This is not to suggest that there are no circumstances in which physical appearance is not important.) The liberation from pre-judgement on non-essential things can be a great boon to many people and teleconferencing can become a more relaxed and satisfying way of doing business. For students taking courses, the freedom to "be at home" or "come as you are" to class may add enjoyment; the class can become a relaxing session at home rather than the long trek across town in work clothes after a long day at the office or school.

Body language in video teleconferencing presents some particular problems. As users have remarked, even with the visual element it is not like being there. The type of system (e.g., the number of cameras and how they are controlled), the number of participants, the hand on the camera control, and the amount of movement in the room (e.g., to blackboards or visual displays) will affect the perception of body language. Watching a ball game on TV gives a very different view of the plays and players than being at the game -- but many prefer to watch TV. As with the TV ball game, video participants are limited to what the camera chooses to show them. They cannot select the person to watch unless the camera always shows a complete group shot. A chairperson, or other participant, has only limited access to body cue response to a presentation. Access to the body cues of some participants and not all may be more limited than access to none at all. As others have pointed out [7], people who cannot see themselves on a monitor or those who assume that those who can't be seen can't see, often find themselves in unflattering positions which they wouldn't assume in a face-to-face meetings.

In point-to-multi-point video conferencing, body language is a more open problem and in some ways, consequently, less of a problem. Careful attention to rehearsals and scripting and the use of professional consultants allow the presenter to select his/her body language to convey what is desired.

Where point-to-point video conferencing is used instead of a normal face-to-face meeting, body language becomes an issue of trade-offs, as it is in audio-only meetings. You may not have any instant replays and your angle on the field is controlled, but a good camera man will only get you at your best, and the studio upstairs is a lot closer than the nearest airport. Advising participants on a few modes of decorum and developing a sensitive camera operator may allow video teleconferencing to convey those body cues, and only those body cues, that are relevant and productive to the meetings.

The presence or absence of body cues in a meeting, whether face-to-face or via teleconferencing, will involve trade-offs. The more that is understood about what is being traded each way, the easier it will become for trainers to develop strategies for maximizing the strengths of teleconferencing.

4.3/ Energizing

One of the criticisms levelled at audio teleconferencing is that meetings are more tiring than those held face-to-face [8] because of the need for greater concentration and the absence of the reinforcing visual cues. Teleconferencing fatigue may result from intense concentration and the ensuing involvement or it may spring from the boredom which often arises from listening to prolonged audio-only without compensation for the releases which may be built into face-to-face meetings. (Face-to-face meetings may also be tiring, but the factors which influence fatigue may be magnified in a teleconference, particularly if it is audio-only.) Maintaining the right energy level in any meeting is a difficult task. It becomes important, therefore, for an educator/trainer to understand which energy sources may be lost with the physical presence of participants and which others may be added. For example, for some people, teleconferencing from their own surroundings, having access to more data (files, books, etc.), being able to move at will throughout the room, or having a ready supply of coffee on hand may increase the energy level. For some, the flight or road trip may deplete the energy needed for proper involvement in the meeting; for others, getting out of the office or home may, in fact, "charge" the person with new energy levels.

Body language or physical presence of others can itself be an energizer. Motivation and involvement can be stimulated by the excitement and enthusiasm conveyed by body movements, such as hand or arm movements, angle or position of torso, or body tension. Audio teleconferencing must capitalize on the energy conveyed by voice -- tone, pitch, speed, and volume. Participants must learn to "feel" the excitement in a voice, even when it is not "in the air."

Whether in a business meeting or educational setting, successful task completion requires energetic involvement from the participants. In face-to-face meetings, information is supplied to the attendees from various sources. While verbal information is being delivered, a listener may be processing the information, preparing a response, noting the reactions of others, assessing the presenter, and taking in other data available from the physical surrounding. The absence of some of the sources of information may result in the participant channelling all his/her energy into listening to the information given and preparing a response and, thereby, becoming tired more readily, or using the "unfilled channels" to daydream or work on other things at hand, thus fragmenting attention, dividing energy, and accomplishing neither task effectively. Careful attention is necessary to maintain a balance between too intense and too lax involvement. Important factors in maintaining a high energy level include

- a well-planned agenda or course design with clearly stated objectives and work plan and adequate opportunity for interaction;
- a supply of sufficient and appropriate written documents, slides, and overheads to allow the movement from aural to visual stimuli;
- built-in changes of speakers, pace, tone, and humour;
- a realistic sense of time;

- built-in coffee or stretch breaks;
- well-prepared presenters; and
- a controlled sense of the objectives to be accomplished.

Teleconferencers do not always have the advantage of carrying on side conversations when boredom strikes, but when they do, the conversations are unobserved by the presenter and can result in wasted time and uncompleted business.

4.4/ Bonding/Cohesion

The problems associated with "energizing" a teleconference pertain as well to the question of "bonding" or group cohesiveness. According to John Naisbitt, "teleconferencing is so rational, it will never succeed": high technology in society requires a balance of "high touch" or involvement with people, and "the more technology we pump into the society, the more people will want to be with people" [9]. Alvin Toffler argues on another line:

> The popular fear that computers and telecommunications will deprive us of face-to-face contact and make human relations more vicarious is naive and simplistic. In fact, the reverse might very well be the case. While some office or factory relationships might be attenuated, bonds in the home and the community could well be strengthened by these new technologies. Computers and communications can help us create community. [10]

He continues to say that "communications, selectively applied, can serve the goal of telecommunity. In short, as we build a Third Wave civilization there are many things we can do to sustain and enrich, rather than destroy, community" [10]. The key to Toffler's statements may lie in the phrase "selectively applied."

Teleconferencing has never claimed to replace all travel, but has claimed to improve communication. Regular interaction via audio teleconferencing may increase the feeling of being part of the group, whether for a manager in a regional office or a remote student struggling with what would have been formerly a print-only correspondence course.

Perhaps, Naisbitt's comments may apply only to video conferencing, and audio conferencing, like the telephone, may become sufficiently "low tech" to generate a "high-touch" sense of communication. Certainly the Bell Canada advertisements for that "long-distance feeling" are designed to suggest just that. CB operators also develop strong bonds through common interests without visual presence of any kind.

Teleconferencing has the potential to isolate and divide members of a group or to establish cohesion and involvement among potentially isolated members. The issue facing educators and trainers is how to use the positive aspects to establish a "high-touch" feeling, to create a sense of group bonding whether the members are in one room or scattered across the country. For users, it is a question of the use of "acoustic space."

Persons accustomed to having their meeting space filled with other people with their body language, as well as with the visual aspects of the meeting room and background noises, may find meeting in acoustic space disconcerting at first -- but then so did the first users of the telephone. Visualizing other participants and locations at times may be helpful. Sending pictures or slides of presenters and/or participants has been used and advocated by some. Brief verbal descriptions may help if the locations are limited in number but can become counterproductive if too numerous. On many occasions participants will have to learn to transfer their knowledge of working in acoustic space with one party on the telephone to doing it with numerous parties on an audio teleconference.

Video conferencers will find that meeting space has not become acoustic but has been curtailed. Maintaining group cohesion will involve "dissolving" the boundary that divides the table in two and can potentially create two separate and opposing groups.

5/ ENDNOTES

[1]See Part 7, on telehealth.

[2]Many of the ideas in the following section arose from a one-day intensive workshop entitled "High-Tech as High Touch: Interpersonal Issues in Telecommunications," a structured collegial discussion focusing on the personal and interactional components of teleconferencing. Co-ordinated by OISE Distance Education Project and the TEMP Teleconferencing Task Force. November 16, 1984.

[3]Liz Burge, Questions for small group work. See note 2.

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PART 5/

BUSINESS APPLICATIONS

1/ INTRODUCTION

Teleconferencing use in Canadian business is uneven: some use it extensively; others not at all. In 1982, the Ontario government's TEMP Teleconferencing Task Force conducted an extensive survey of teleconferencing use in Ontario, which revealed that audio teleconferencing dominated the market. This remains true today, although use of audio plus text, graphics, and freeze-frame video appears to be growing, particularly with the proliferation of work stations. Full-motion video remains the domain of only a few. Teleconferencing is being used for a wide range of purposes by virtually all functional areas. Part 5 provides an overview of teleconferencing in Canadian business and reviews, in some detail, specific applications, including Polysar, 3M, the Bank of Montreal, CBC, Consult Ltd., Motorola, Cooperator's Life, Lavalin, Telemedia, Dominion Securities/Pitfield, Vahalla Companies, Wood Gundy, IBM Canada, Pratt & Whitney, General Motors, Westinghouse, Bell Canada, the Royal Bank of Canada, and Indal.

2/ OVERVIEW

2.1/ Survey Methodology

TEMP's Survey of Teleconferencing Use in Ontario [1] was undertaken in 1982 to assess the level of use in Ontario business, as well as plans for the future. Attitudes to teleconferencing, particularly its advantages and disadvantages, were also of considerable interest. Individuals in over 300 large (more than 250 employees) decentralized businesses headquartered in Ontario were interviewed. While the survey may be representative of Canadian business as a whole, there are some indications that teleconferencing is not as well developed in other provinces [2].

For the purposes of the survey, teleconferencing was defined broadly as "meetings or information exchange between two geographically separated placed involving at least three people, in which electronically transmitted voice and/or images are the means of communication." The study aimed at exploring use of all forms of teleconferencing.

2.2/ Type of System

Approximately 72% of the companies contacted used some form of teleconferencing, almost exclusively audio. Inexpensive, telephone-based systems are the most common methods of teleconferencing:

- speakerphones, by about 75% of the users;
- the Bell conference operator, by about 50%;
- private bridges, most often PBXs with bridging capability, by about 25%;
- Conference 2000 systems and CNCP broadband, by 15 and 6% of users, respectively.

Over half of the users used more than one type of teleconferencing.

Other forms of teleconferencing appear to be used to a limited extent, but there are problems with interpreting the responses. Despite efforts to define the terms clearly, some confusion seems to have existed in the minds of respondents. Approximately 16% of users report using computer conferencing or electronic mail (Table 1). None of the companies surveyed were using slow-scan or full-motion video. While other respondents indicated that they were using telex, telecopiers, electronic graphics, and communicating word processors, it is not clear that they were using them for teleconferencing rather than for other purposes. In addition, some respondents may have interpreted telecopier to mean photocopier. Electronic graphics do not seem to have been well-known or understood.

2.3/ Extent of Use

Determining the extent of use of teleconferencing was a difficult task, as terms such as "high" or "low" are subjective and relative to the size of the organization, the number of locations reported for, and the type of teleconferencing in question. Therefore, an effort was made to determine the typical or median frequency of use for the main types of teleconferencing in small, medium, and large organizations. Companies were further divided into those reporting for one location and those reporting for many. Most devices appear to be used about one to four times per week. However, the Bell conference operator was used less frequently, often only a few times a year, and CNCP broadband was used daily. As one would expect, larger companies use teleconferencing more frequently than smaller ones. Respondents reporting for many locations reported higher use than those reporting for a single location (Table 2).

Based on the median frequency of use for the size of company, the number of locations being reported on, and the type of teleconferencing used, users were divided into frequent and infrequent users. Frequent users are those above the median; infrequent users are those below. In the study, differences between these groups, as well as between users and non-users, were investigated.

2.4/ Applications

Teleconferencing was used by the following departments within user companies:

- 92% of administrative/finance departments
- 77% of marketing/sales departments
- 52% of personnel
- 51% of data processing
- 47% of production
- 42% of engineering/research

The user companies used teleconferencing for the following purposes (Table 3):

- 92% for information exchange -- an extremely general term
- 66% for problem solving

- 58% for planning
- 42% for committee and staff meetings
- 21% for inspection/supervision and training

3/ ATTITUDES TO TELECONFERENCING

3.1/ Advantages and Disadvantages

Satisfaction with teleconferencing among users seems to be relatively high. Most (54%) expected use to increase in the next two years; only 2% expected it to decrease. Frequent users were more inclined to expect it to increase (66%) than infrequent users (45%). This suggests that they are more satisfied with the medium. Only 20% of non-users expected the use of teleconferencing to increase in their company (Table 4).

The advantages and disadvantages reported by users were fairly consistent with evaluations of teleconferencing conducted within the government and elsewhere. The principal advantage cited was that it saves time (61%). Users also believed that it saves money (37%), improves general efficiency (18%), and allows more staff to attend meetings (18%). Non-users cited the same advantages but much less frequently (Table 5).

Many users (35%) reported no disadvantages, but major ones noted include the following:
- loss of face-to-face contact (17%),
- the high cost of teleconferencing (13%),
- equipment problems (7%), and
- the difficulty of arranging schedules (5%).

Non-users, on the other hand, perceived the cost of teleconferencing to be its chief disadvantage (14%) and believed that it was simply "not suitable for all companies" (13%) (Table 6).

3.2/ Attitude Statements

In addition to exploring general responses to teleconferencing, the study attempted to examine opinions about specific issues, including voice quality, costs, potential use, and other factors which might affect the extent of use (Table 7). Respondents were asked to rate the accuracy of statements about teleconferencing on a 1 to 10 scale. As often happens with this type of scale, opinions tended to cluster in the middle, around the 4 to 7 range. Because these responses were difficult to interpret accurately, they were divided into three groups:
- Neutral (4 to 7)
- Strongly agree (8 to 10)
- Strong disagree (1 to 3)

Using this analysis, a number of conclusions were drawn.

In general, users seemed to believe that lack of awareness is the principal problem:

- A vast majority (70%) of users strongly believed that senior management support is needed before companies will use teleconferencing.
- Almost half (45%) strongly believed that reducing travel time or cost is a major reason for adopting teleconferencing.
- In addition, 42% strongly felt that once someone knows the facts about teleconferencing, they will make make use of it.
- Similarly, 49% strongly believed that once people gain an understanding and some exposure, they will use it.
- Most (40%) strongly disagreed that people resist teleconferencing because they enjoy travel.

There seems to be a certain amount of satisfaction with the quality and cost of teleconferencing:

- Half strongly agreed that with today's equipment, quality is not a problem; 5% strongly disagreed.
- Similarly, 35% strongly disagreed that quality must improve before their company will use teleconferencing; 12% strongly agreed.
- Likewise, 35% strongly disagreed that "with the cost of video you might as well fly"; 15% strongly agreed.

In some areas, however, there was little agreement. While one-third of users felt that their company could make more use of teleconferencing, one-fifth strongly disagreed. Opinion was also split on the issue of substitutability: one-third strongly agreed that audio teleconferencing could not replace a face-to-face meeting, while 18% strongly disagreed.

The differences between frequent and infrequent users were not pronounced. There was some indication, however, that infrequent users may perceive teleconferencing as expensive. They were less likely to see teleconferencing as a means of saving money (30 vs. 45%) and were more likely to cite the expense of teleconferencing as a disadvantage (15 vs. 10%).

The response of non-users to the statements was distinquished in several ways. They tended to rate quality and cost more negatively than users, although differences were not significant. In addition, they were less likely to believe that once people knew the facts or were exposed to teleconferencing they would adopt it. Finally, non-users appear less inclined to believe that their company can make more use of teleconferencing.

4/ BUSINESS TRAVEL

Most business travel appears to be to company locations outside of Ontario and within the organization (Table 8):

- A majority of the companies surveyed (54%) reported that their travel was mainly outside the province. Only 18% indicated that their travel was mainly within Ontario, although almost all companies had some trips involving this province. Over one-quarter (26%) reported that travel is split between trips within and trips outside Ontario.

- Most firms (54%) indicated that travel was mainly within their organization, but over one-quarter (27%) said that it was mainly outside their company. Again, 17% indicated that travel was split.

Montreal was the most frequently noted destination (17%), with travel to Vancouver (12%), Calgary (8%), and Ottawa (8%) also mentioned. In most cases (77%), the means used was airplane, but automobile travel was not insignificant, accounting for 19% of trips. Use of bus, train, and other forms was negligible. The reasons for business travel roughly paralleled the purposes of teleconferencing. The most notable difference between the two lists is that sales was included as a purpose for business travel but was omitted from the list of purposes of teleconferences.

There is evidence that the extent of travel is a concern in many businesses. About 65% of the companies surveyed had attempted to reduce travel through various measures, including instituting tighter controls and encouraging the use of other types of communications (Table 9).

There were some differences in the travel patterns of users of teleconferencing and non-users. In general, both groups indicated similar amounts of travel, destinations, and modes of travel. However, non-users would appear to travel outside their organization (36%) more often than do users (23%) (Table 8). In addition, for non-users, sales was cited more often as a purpose of travel than it was for non-users. Finally, there was less evidence among non-users of interest in reducing travel (Table 9). A larger proportion of users (69 vs. 54%) had taken steps to reduce their business travel, and this may be one reason for their interest in teleconferencing.

5/ CHARACTERISTICS OF COMPANIES

While all the companies surveyed were large, decentralized firms with over 250 employees, there were some differences between user and non-user firms and between frequent and infrequent users (Table 10). While user and non-user companies had the same average number of establishments (6 to 10), non-users had more small firms and users had more large firms. Frequent users tended to have more establishments than infrequent users, but the difference was not statistically significant. With more establishments, one would expect companies to have a greater need to communicate and, hence, to teleconference. User firms also appeared to be larger in terms of sales than non-users. In addition, users tended to have more employees than non-users. Frequent users appeared to have more employees than infrequent users despite the precautions in dividing the two groups, but the difference was not significant.

Users and non-users were equally likely to be subsidiaries of larger companies and appeared to represent similar sectors. About half were from manufacturing. Frequent users were more likely to be from the retail, insurance, and financial sectors, whereas infrequent users were more likely to be manufacturers and subsidiaries. This may suggest sectoral differences in terms of the applications of teleconferencing.

6/ TRAVEL SUBSTITUTION

The issue of teleconferencing's impact on travel has been the subject of much debate. While many argue that teleconferencing could potentially reduce travel, there has been little empirical evidence of this, largely because of the enormous number of variables involved. Some organizations, however, have documented travel displacement. On self-administered questionnaires, many users claim that had teleconferencing not been available, they would have travelled. Nevertheless, it is rarely possible to find evidence of this in travel budgets, which tend, for many reasons, to increase over time. The survey was not, therefore, attempting to measure travel substitution but to explore people's perceptions to it. The concept seems to have some credence in Ontario businesses.

About two-thirds of users felt that teleconferencing has had no effect on their business travel, while 2% believed business travel has increased as a result of teleconferencing. Almost one-quarter claimed that travel has been reduced (Table 11). They estimated that it has decreased by roughly 20%. However, as this figure was based on only 42 responses, it should be used with caution.

Most (60%) users believed that future trips will be replaced with teleconferencing. They estimated, on average, that teleconferencing could replace future trips by about 25%. The estimates of frequent users tended to be higher than infrequent users (28 vs. 20%). Although this was merely speculation, it is in keeping with theoretical estimates of the potential of teleconferencing to replace business travel. Non-users differed dramatically in their view of the potential of teleconferencing to reduce travel. Although they had no experience with the medium, 90% were certain that it would not reduce travel. Only 9% of users would agree (Table 12). Whether or not they are correct, it is clear than many companies believe that teleconferencing can and will displace travel in the future.

7/ CASE STUDIES

Teleconferencing is used in virtually all segments of industry for all sorts of meetings. The following examples are by no means comprehensive; many of them are based on in-depth interviews with companies which participated in the 1982 survey. While the specific applications vary from organization to organization, certain themes recur throughout: teleconferencing is perceived as a means of increasing productivity, of allowing decisions to be made quickly and effectively, and in some instances, as a means of reducing travel.

7.1/ Bank of Montreal

Although the investigation of teleconferencing at the Bank of Montreal initially focused on video conferencing, a feasibility study revealed that the costs of video substantially exceeded the benefits, and attention shifted to audio conferencing [3]. A survey of current use revealed that many techniques were being used, including Bell Canada conference

calling services, user-operated PBX and Centrex features, and a variety of speakerphone devices. Visual support was being provided by advance mail, communicating word processors, and facsimile.

Also, unfulfilled requirements were identified. Desk-to-desk conferences were adequate for three or four location calls but deteriorated with increasing numbers of sites. The terminal equipment in large conference rooms was not of sufficient quality. As the fundamental requirement for corporate teleconferencing was good-quality audio, substantial improvements were required.

A group of executives in different locations, who met frequently and knew each other well, were selected for a pilot project. They wanted to hold shorter, more frequent meetings, some prescheduled and others on an ad hoc basis. The main communication links were between Calgary, Toronto, Montreal, and New York, with occasional participation from other sites, such as Vancouver, Halifax, Winnipeg, Chicago, and San Francisco. Some of the meetings would involve presentations, followed by questions and answers; others would be interactive throughout. To meet these requirements, the Darome Connection meet-me conference service and Darome conveners were selected. User satisfaction with the system is high, and enhancements are being considered.

7.2/ Polysar

Polysar was involved in one of Canada's first full-motion video pilots in a private company. In 1980, a two-month trial was conducted between the company's plant and nearby head office. Although the system was well received, video teleconferencing was deferred because of the costs.

With its head office in Sarnia and operations spread across the USA and in Europe, Polysar had a serious need to co-ordinate operations at a distance. With assistance from the Ontario government's TEMP Teleconferencing Task Force, Polysar implemented a relatively simple audio conferencing system in 1981, using group terminals (mainly Conference 2000s), conference features on its PBX, and electronic mail. TEMP provided in-depth training on operating the equipment and guidelines for conducting teleconferences. The system has been used to plan and co-ordinate production and marketing activities; for technical sessions, including product development; for manpower planning; and even performance appraisal. In one instance, teleconferencing was credited with replacing a trip to Belgium that would have taken three days and cost over $2000. However, the company also uses teleconferencing for meetings that would not otherwise be held, effectively improving communications. Polysar continues to use public teleconferencing services and is planning enhancements to its existing system [4].

7.3/ 3M

3M is another example of a company using an extremely simple audio conferencing system to obtain significant benefits. Again Conference 2000s and Bell conference calling services, along with PBX bridging, are used

for a wide range of applications. For example, it was used for a series of three conferences involving 12 locations, coast to coast, to allow input to the development of training programs. It is also used to link members of the company's safety and security committee. When a crisis develops, engineering, insurance, and safety management personnel can meet within minutes. Finally, teleconferencing has been used for customer service personnel: once a month for half an hour, sales and service personnel meet with senior management to discuss problems. Teleconferencing is seen as a way of keeping head office in touch with the "grass roots" of the organization.

7.4/ CBS Records

The company uses speakerphones and a private bridge on a regular basis. Teleconferencing is used almost entirely by the marketing department for regular weekly market strategy discussions, all but eliminating travel. Typically, two Toronto offices, Calgary, Vancouver, and Montreal participate in the tightly structured meetings, which usually last about one hour. Teleconferencing is perceived to allow CBS to respond rapidly to changes in the volatile market, and users are very positive about its effectiveness [5].

7.5/ Consult Limited

Consult Limited is a consulting engineering firm with staff from coast to coast, which uses speakerphones, a Conference 2000, and a bridging feature on their PBX almost on a daily basis. Typically, teleconferences involve seven people in three sites in meetings ranging from 15 minutes to as much as three hours. All departments use it for committee meetings, planning, review and updates, and board meetings. Because the company does a lot of business in the Middle East, teleconferencing is used for many of its technical and financial discussions. The chief benefit, however, is not travel saving but convenience: teleconferencing is perceived to expedite decisions and save time [6].

7.6/ Digital Equipment Corporation (DEC)

At DEC, teleconferencing is part of an overall effort to reduce travel by making more effective use of telecommunications. Most of the applications are between offices in Kanata, Toronto, Calgary, and Montreal, involving decentralized departments. The meetings tend to be formal and pre-scheduled. While DEC in the US has a private full-motion video system, the Canadian arm of the organization has used point-to-multi-point video for new product introductions. Teleconferencing is seen to have resulted in travel avoidance, but again, its value as a fast, easy, and effective means of making business decisions is emphasized [6].

7.7/ Motorola Canada

Virtually all of the company's 40 different departments use teleconferencing. Most of the applications are ad hoc consultations rather than formal meetings. Although the actual magnitude of its impact is

difficult to measure, travel has definitely been avoided and productivity has improved [7].

7.8/ Lavalin

Lavalin is an umbrella holding company for several engineering firms and has over 50 locations nationwide. In some cases, teleconferencing is used at the executive level in developing corporate policy, but the majority of teleconferences are for engineering purposes, often to link consulting engineers to a remote construction site when problems occur. Supporting documentation is telecopied in advance. At Lavalin, it is felt that thorough advance preparation is a key factor in ensuring the effectiveness of teleconferences. While there is little evidence that travel has been reduced, teleconferencing is thought to have significantly impacted on productivity. In general, it works well, although there have been minor difficulties where participants have been working in a second language [8].

7.9/ Telemedia

Teleconferencing has been strongly promoted within Telemedia. Most regular use is for three-way calls established by the participants. The company's board of directors, in 10 different sites, meets four to five times per year via teleconferencing. In addition, the 11 member management team meets with regional directors, again spread across 10 sites, about four times a year. In the broadcast division, teleconferencing is used to conduct interviews with sports personalities in several remote sites simultaneously; some are taped, but some are broadcast live. It is felt that over the past five years, teleconferencing has led to a significant reduction in travel. As management spends most of their day in meetings, they are very conscious of its potential to save time. Again, teleconferencing's impact is felt on the speed of decision making: fast reaction time is critical to survival in the media business [9].

7.10/ Valhalla Companies Limited

At Valhalla, teleconferencing is a regular way of doing business. Matters related to leasing, financing, and legal affairs are often handled in this way. Typically, the general manager and two department heads might teleconference with a lawyer or financial consultant, or senior management can meet with company staff and a consultant without travelling downtown. Teleconferencing is thought to have reduced travelling substantially, particularly intra-city travel. Because many outside consultants, lawyers, and financial advisors bill by the hour, the time saved teleconferencing has significant value. Enhanced productivity, particularly senior management productivity and faster decision making, are important benefits [10].

7.11/ Wood Gundy

The company uses teleconferencing on a daily basis for meetings of institutional managers on a national and international level. Two dedicated

bridges and two Conference 2000s (with additional microphones) are used. For the past three and one-half years, a conference has been held each morning at 8:30 am, before the markets open, to keep all participants abreast of developments. There are often as many as 50 people in Toronto, although many of them attend to gather information and do not actively participate. The participants include between 5 and 10 people in New York, 1 person from Vancouver joining in at 5:30 local time, 10 to 20 from Montreal, 1 or 2 people from England, 2 people from Boston, and 1 from Washington. The teleconference is very structured to ensure it is effective. The agenda is not transmitted in advance but is read aloud at the start of every meeting.

One bridge is also used daily by the new issues department to meet with participants from London, England, New York, and the major Canadian branches. Many other departments, such as retail sales, money market, and bonds, use the bridge on a weekly basis for half-hour meetings with other regional, national, and international offices. Similarly, the director and the chairman of the board meet with the New York and London, England offices once a week.

These teleconferences are not used to substitute for travel; they improve communications throughout the company and promote timely dissemination of information, thereby promoting more effective management and decision making [11].

7.12/ The Cooperators General Insurance Company

The company, headquartered in Guelph, with offices in Calgary and Moncton, is part of the Cooperators Group, which includes four different companies spread across the country. Traditional methods of communicating (courier, telephone, and face-to-face meetings) presented several problems:

- Meetings were often difficult to arrange and costly.
- There was a need to improve the timeliness of information exchange and decision making.
- The company's ability to react to changes in its environment needed increasing.

To alleviate these problems, audio conferencing and electronic mail were introduced. Three-way conferencing features, speakerphones, and Conference 2000 were installed throughout the organization, to support desk-to-desk conferencing as well as meeting room conferences. Although the company experienced some initial difficulties with audio conferencing, largely due to inadequate training, users are currently satisfied with its application to relatively short (less than two-hour) meetings. The company is, however, continuing to investigate other technologies [12].

7.13/ IBM

A few years ago, travel between Toronto and Montreal cost the company in excess of one million dollars per year. A full-motion video trial was established between the two sites to provide an alternative. The system

included three cameras (one for people, one for a flip board, and an overhead camera for graphics), two incoming monitors, and one preview monitor. Encrypted freeze-frame was sent with the motion video signal, and the audio link was established separately. An extensive training program was conducted to introduce staff to teleconferencing, and data on usage were collected after each meeting. Typically, the system was used from 12 to 20 hours per month for a number of applications, including market planning and project co-ordination [13]. Eventually, however, for a number of reasons, including the company's head office relocation and the high cost of full-motion transmission and line charges, the project was terminated.

Today, IBM Canada is part of IBM's worldwide freeze-frame video conferencing system. Each site contains a three-camera, three-monitor system based on the IBM XT computer and an audio terminal (often the Conference 2000). A computerized reservation system is used to book conferences. In Canada, extensive promotion of the freeze-frame system has not yet begun. Nevertheless, it is used approximately three times per week for meetings with White Plains, New York.

7.14/ Royal Bank of Canada

The Royal Bank of Canada has one of the country's only private, full-motion video conferencing systems. Studios, designed primarily for executive use, are located in Toronto and Montreal [14]. The systems are controlled by an operator, usually a secretary, and employ large rear projection screens to provide life-size images. Extensive research and experimentation went into the development of the system. A custom-designed audio system is an integral part of the system.

Senior management initiated the investigation into video teleconferencing to improve productivity and integrate the bank's function. While it has not eliminated travel, it has reduced its frequency considerably. The system is used approximately 35 hours per month, and satisfaction with it is high.

7.15/ Bell Canada

In 1981, Bell Canada, in co-operation with the TEMP Teleconferencing Task Force, launched an in-house audio teleconferencing trial. Conference 2000 units were installed in Toronto, London, and Ottawa, and Bell conference calling services were used. An extensive promotional program was undertaken: brochures, posters, and even reminders with travel vouchers urged employees to teleconference rather than travel. Usage of teleconferencing was monitored for six months. Based on a sample of 196 teleconferences, it was estimated that 243 trips were displaced; the chairman indicted that in 85% of the teleconferences some travel was avoided. The most frequently cited benefits were saving time (82%) and saving money (74%). The most frequently cited disadvantages were the loss of face-to-face contact (77%) and the inability to show charts and graphics (33%). Overall, satisfaction was high: the average score was 4 on a scale of 1(extremely dissatisfied) to 5(extremely satisfied).

"Based on the positive experience of the TEMP promotion trial, Bell, Ontario region, committed itself to maximize internal use of teleconferencing as a means of reducing travel and increasing productivity" [15]. The program was expanded to all Ontario region offices. In addition, a new service, "auto conference," was introduced, based on small, automatic, user-controlled, meet-me bridges. As well, trials of audio-plus-Telidon and freeze-frame video were initiated.

In 1982, Bell, Ontario region, became actively involved in marketing teleconferencing to the business community by introducing a number of new products, expanding its sales and distribution system, developing extensive training programs, and launching an advertising and promotion campaign. In 1983, black-and-white, freeze-frame video units were installed in Toronto, Ottawa, London, Montreal, and Quebec City. The principal benefits of teleconferencing at Bell Canada have been improved productivity and communications. The company also estimates that in 1983, approximately $180 000 in travel costs were avoided through use of the freeze-frame system.

7.16/ Westinghouse

Westinghouse recently installed an Nippon Electric Company (NEC) colour, freeze-frame video system in Hamilton. While it had originally been planned for use in a specific project with Proctor and Gamble, it has been used for other purposes, including meetings with head office in Pittsburg. Currently used several times a month, its use is expected to grow dramatically. Applications to date have included use by senior executives to make major equipment purchasing decisions and for meetings with customers regarding design, construction, installation, problem solving, and service [16].

7.17/ Honeywell

Honeywell has used audio teleconferencing on a weekly basis for approximately 20 months to keep track of technical problems with their customers' computer systems. They have a Technical Assistance Centre (TAC) in Toronto, from which hardware and software specialists communicate with more remotely located servicemen by long-distance calling. To discuss the progress of all problems, all of which are kept in an on-line computer file (the alert file), weekly teleconferences are held between field managers, TAC managers, and head office. Just before the meeting, all of the participants print out a copy of the alert file, which thus acts as an agenda. Honeywell has achieved a significant improvement in their customer satisfaction level because of the improved management awareness that teleconferencing provides [17].

7.18/ General Motors

General Motors has an Interand colour, freeze-frame system in place in their Windsor plant, which is used mainly for quality control purposes. Assembly plants can discuss robotic problems with each other with the aid of highly detailed colour frames on the display monitor. Once this

system has been relocated to a room specifically designed for teleconferencing, GM expects 15 to 20 hours of use per week between Windsor, the central engineering plant in Warren, Michigan, and several other plants located in Michigan and Missouri [18].

7.19/ Pratt & Whitney

Pratt & Whitney has just recently installed a colour, high-resolution freeze-frame system for a specific project involving the development of a new engine for the United States military. Systems were installed in four of their plants: the main plant in Montreal, two plants in Hartford, Connecticut, and the government products plant in West Palm Beach, Florida. The engine will actually be designed and built via multi-point conferencing between these locations [19].

7.20/ Dominion Securities Pitfield

Dominion Securities Pitfield has had a Centrex 3 system with a 30-port conference feature in place for two years now, although for the first year, it was as a field trial. With branch offices from coast to coast as well as New York city, the system is used virtually every day. Directors from 18 different ports meet regularly three mornings per week with the system, and the marketing division has connected up to 22 ports at their frequently held meetings (three to four per week). For executives' and directors' use, a room was designed specifically for teleconferencing, with such features as special panelling on the walls and hidden microphones in the ceiling. This room is used approximately four times a week [20].

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Table 1/ Type of Teleconferencing Used

Device/Method	Total Sample (%) (N=307)	Users (%) (N=221)	Total Sample Using This Device Only (%)
Speakerphone	54	75	25
Bell Conference Operator	38	53	13
Private Bridge	19	27	6
Conference 2000	10	15	2
CNCP Broadband	4	6	0
Computer Conferencing/ Electronic Mail*	13	16	-
Any of the Above Devices	72	100	-

* Another device is always used.

Table 2/ Median Frequency of Use of Teleconferencing Devices

Reporting for	One Location			Many Locations		
Establishment Size	Small	Medium	Large	Small	Medium	Large
Speakerphone	M [2]	D	W	M	W	W
Bell Conference Operator	Y [2]	Y	M	Y [2]	Y	M
Private Bridge	Y [2]	M [2]	W [2]	W [2]	W	W
Conference 2000	Y [2]	D [2]	W [2]	Y [2]	W [2]	M [2]

[1] D = Daily
W = Weekly: 1-4 times per week
M = Monthly: 1-3 per month
Y = Yearly: Less than one per month

[2] Based on less than 10 respondents

Table 3/ Applications of Teleconferencing

Application	% Users 0 25 50 75 100
Information Exchange	
Problem Solving	
Planning	
Progress Reviews	
Committee Meetings	
Staff Meetings	
Inspection/Supervision	
Training	
Others	

Table 4/ Expected Use of Teleconferencing

	Total	Users	Freq. Users	Infreq. Users	Non-Users
Increase	53	54	66	45	20
Stay the Same	42	41	32	48	70
Decrease	2	2	0	4	-
Not Stated	3	2	2	2	10

Table 5/ Advantages of Teleconferencing

Advantage	Total Respondents (%)	Total Users (%)	Freq. Users (%)	Infreq. Users (%)	Non-Users (%)
Speed/Saves Time	52	61	67	56	31
Cost/Saves Money	32	37	45	30	19
General Efficiency	16	18	18	18	11
More Staff Attend Same Meeting	16	18	14	20	11

Table 6/ Disadvantages of Teleconferencing

Disadvantage	Total Respondents (%)	Total Users (%)	Freq. Users (%)	Infreq. Users (%)	Non-Users (%)
None	30	35	39	32	16
Lose Face-To-Face Contact	14	17	16	19	5
Cost/Expensive	13	13	10	15	14
Equipment Problems	6	7	7	7	1
Arranging Schedule	4	5	6	5	1
Security/No Privacy	2	2	2	2	1
Not Suitable for All Companies	4	0	0	0	13

Table 7/ Attitudes Towards Teleconferencing

Attitude Statement	Users				Non-Users			
	8-10	4-7	1-3	Don't Know	8-10	4-7	1-3	Don't Know
With today's modern equipment, voice quality isn't a problem when using telephone lines.	50	40	5	5	40	20	12	29
Audio teleconferencing can never replace a face-to-face meeting.	33	43	18	5	36	31	8	24
Before our company would use teleconferencing, the quality would have to improve.	12	34	35	19	13	14	20	54
Once someone knows the facts about teleconferencing, they will make use of it.	42	44	7	7	25	26	14	36
With the cost of video teleconferencing, you might as well fly there.	15	26	26	34	9	9	21	61
The use of teleconferencing needs senior executive support before companies will use it.	70	20	4	6	64	4	5	28
Our company could make more use of teleconferencing.	33	36	20	10	10	27	27	37
More people would make use of teleconferencing if they didn't enjoy travelling so much.	16	35	40	9	13	25	33	30
One of the most important factors in reducing travel costs and time is teleconferencing.	45	35	10	10	23	36	8	33
Once people gain an understanding and some exposure to teleconferencing, they will start to use it.	49	42	5	5	22	38	7	33

Scale: 8-10 Strongly Agree 4-7 Neutral 1-3 Strongly Disagree

Table 8/ Business Travel Patterns

Pattern	Total Respondents (%)	Total Users (%)	Freq. Users (%)	Infreq. Users (%)	Non-Users (%)
Mainly Within Organization	54	57	52	61	47
Mainly Outside Organization	27	23	21	25	36
Both Equally	17	19	26	13	14
Don't Know	1	1	2	1	1
Mainly Within Ontario	18	16	14	18	23
Mainly Outside Ontario	54	56	51	61	48
Both Equally	26	26	33	21	27
Don't Know	1	1	2	1	0

Table 9/ Steps to Reduce Travel

Steps to Reduce Travel	Total Respondents (%)	Total Users (%)	Freq. Users (%)	Infreq. Users (%)	Non-Users (%)
Have taken steps	65	69	67	70	54
Have not	34	29	31	28	44
Not stated	1	2	2	2	0
Steps Taken:					
Only take necessary trips	30	31	31	31	28
Tighter control/ cutbacks	32	35	29	39	22
Combine trips	8	9	8	9	7
Reduce number of travellers to one point	8	7	8	7	9
Use other type of communication	32	33	40	28	30
Reduce number of meetings	3	2	2	2	4

Table 10/ Summary Profile of Firms

Characteristic	Total	Users	Median Categories		
			Non-Users	Freq. Users	Infreq. Users
Number of Establishments	6-10	6-10	6-10	11-24	6-10
No. of Employees Across Canada*	400-700	400-700	250-500	700-1000	400-700
Estimated Annual Sales* ($ Millions)	50-99	50-99	0-49	50-99	50-99
Annual Travel Budget ($ Thousands)	0-100	100-500	0-100	100-500	100-500

* Uses Dun & Bradstreet Information

Table 11/ Perceived Effect of Teleconferencing on Travel

Effect	All Users (%)	Frequent Users (%)	Infrequent Users (%)
Decreased Travel	24	31	19
No Effect	67	60	73
Increased Travel	2	5	0
Don't Know	6	4	8
Trips Replaced			
0 %	3	0	6
1-14 %	25	24	27
15-29 %	19	27	12
30-60 %	15	18	12
Don't Know	37	32	42
Mean Trips Replaced	19	22	16

Table 12/ Estimates of the Effect of Teleconferencing on Future Business Travel

Future Trips Replaced	Total Respondents (%)	Total Users (%)	Freq. Users (%)	Infreq. Users (%)	Non-Users (%)
0 %	31	9	5	11	90
1-14 %	14	19	17	21	1
15-29 %	13	18	18	18	1
30-60 %	14	18	21	15	5
61-100 %	3	4	5	2	0
Don't Know	25	34	35	32	4
Mean Trips Replaced	16	24	28	20	3

PART 6/

GOVERNMENT APPLICATIONS

1/ INTRODUCTION

Various departments in both the provincial and federal governments in Canada use teleconferencing to co-ordinate regional activities, hold committee meetings, conduct training specials, enhance services, and hold special events. Again, there is no consistency in the extent to which teleconferencing is used. Some departments have policies aimed at promoting its use; others do not. Part 6 reviews the use of teleconferencing in the Government of Ontario in some detail and will provide an overview of teleconferencing in the other provinces as well as at the federal level.

2/ ONTARIO'S EXPERIENCE

2.1/ Background

Ontario's large geographical size and scattered population have posed unique problems for the delivery of services by the provincial government. Most of the nine million inhabitants live in the south; the rest live in cities, towns, and tiny communities in the vast north. Provincial ministries with responsibilities for health care, education, social services, transportation, resource management, revenue collection, and so forth are highly decentralized, with regional offices in major cities and district offices in smaller towns. Most policy making and administrative functions are concentrated in or near the provincial capital, Toronto. Considerable interaction is required among the organizational units to obtain regional input to decision making and to co-ordinate various programs. In addition, many professional and specialist health and educational services tend to be concentrated in the south.

The government began investigating teleconferencing both as a means of reducing travel and of improving services throughout the province. In 1980, a special task force was created, including members from the Ministries of Transportation and Communications, Energy, and Government Services, to promote teleconferencing as a substitute for travel, as part of the province's Transportation Energy Management Program (TEMP) [1].

2.2/ User Needs

Defining teleconferencing requirements for the government, however, was a complex task. The scope of the problem was immense -- 23 administratively autonomous ministries, plus crown corporations and secretariats with another 85 000 employees situated in hundreds of different locations. Moreover, most of the technology was untested, and potential users were unfamiliar with its operation. Some groups were receptive to the idea; others were not. In addition, the need for teleconferencing emerged at at least two levels: some services could be shared by all ministries; others had to be tailored to specific needs.

Different approaches were taken to defining user needs. In some instances, formal surveys were done to determine requirements. In others, pilot projects were established.

2.2.1/ MTC Surveys

The Ministry of Transportation and Communications (MTC) carefully assessed needs in terms of key travel linkages, meeting requirements, and attitudes to teleconferencing and travel.

The conclusions of MTC's assessment of user needs were
- that audio teleconferencing was sufficient for most meetings, with supporting documents mailed or transmitted by facsimile in advance;
- that a high-quality network (which could allow interaction between five or six locations) was required to link head and regional offices;
- that the telephone network, being flexible and universally available, could be used for other meetings; and
- that a significant training and promotional effort would be required to gain acceptance for teleconferencing [2].

The MTC study was extremely valuable, and consequently, some ministries have followed suit with extensive research. Others have relied on more informal means to determine their requirements.

2.2.2/ Ministry of Government Services (MGS) Pilot Projects

Because teleconferencing was a new concept, the Ministry of Government Services (MGS) elected to define system requirements through a series of experiments and trial projects. In addition to helping to establish parameters, these trials provided hands-on experience with emerging technologies.

Working in co-operation with the federal Department of Communications (through the 1970s), MGS conducted experiments with teleconferencing via satellite. Satellite earth stations were placed in Thunder Bay, Dryden, Pickle Lake, Sioux Lookout, Winisk, and several base camps in Northwestern Ontario. Various types of teleconferences, including audio, freeze-frame, and full-motion video were held using the Communications Technology Satellite (CTS) [3]. These experiments demonstrated the viability of teleconferencing for service delivery and the need for further investigation [4].

The Anik B satellite was then used for tests of colour freeze-frame and full-motion video. Although full-motion video was considerably more expensive than freeze-frame, it was preferred for a number of reasons:
1/ It allowed observation of "body language," which was essential for applications such as psychiatric interviews.
2/ Because it resembled television, full-motion video was readily accepted by users and required little advance preparation or training.
3/ In addition, at that time, freeze-frame equipment from different suppliers was not compatible, and there were problems with servicing the equipment in Northern Ontario.
4/ It was concluded that full-motion video would be easier to install and maintain, at competitive prices.

2.3/ Operational Systems

The Ontario government currently uses audio, audio-plus, and full-motion video teleconferencing. Some of the facilities are shared services. Others are for the exclusive use of particular ministries. While some ministries have been using teleconferencing for several years, others have had their facilities in place for less than a year.

2.3.1/ Audio

CNCP Broadband
In cases where the volume of traffic and size of meetings warranted it, special networks were installed, linking head and regional offices.

At MTC, for example, it was felt that a high-quality system was required to link the head office in Downsview with regional offices in Toronto, North Bay, Thunder Bay, Kingston, and London, Ontario. CNCP broadband was installed for teleconferences between prearranged sites.

Two other ministries, the Ministry of Northern Affairs and the Ministry of the Environment, have similar systems.

Telephone Network
While CNCP broadband proved effective for teleconferences between predetermined sites, the flexibility and universality of the regular telephone network makes it a desirable medium for audio conferencing. With improvements in terminals and bridging, telephone-based systems are becoming the dominant form of teleconferencing in the Ontario government. Bell conference calling services, though readily available, has been used only to a limited extent, largely because of the cost.

In 1983, with TEMP's assistance, a private teleconferencing bridge was installed, which enables users to teleconference on toll-free government tie lines. This has fuelled the adoption of teleconferencing in the Ontario government. The bridge, custom-designed by Wescom Canada, enables up to 14 participants to be connected simultaneously in a meet-me mode.

A number of ministries, including the Ministries of Health, Energy, Education, Natural Resources, and Community and Social Services have acquired group conference units for use on two-point and multi-point calls.

2.3.2/ Audio Plus Visual Support

While it is common to mail materials in advance, electronic means of distributing documents have become increasingly popular. The government's extensive telex and telecopier networks are used. With advances in office automation, electronic mail and communicating word processors are becoming more popular means of supporting audio conferences.

2.3.3/ Full-Motion Video

Following the demonstration projects, the Ministry of Government Services implemented a colour, full-motion video system for the use of all government ministries. Initially, studios were installed in Toronto and Thunder Bay, a city with over 100 000 people more than 1500 km from Toronto. Most ministries have regional offices in the city in "mini Queen's Park," and a considerable amount of travel takes place between the two sites. Links can also be established with Bell Canada studios in Ottawa, Montreal, and Quebec city, and with other sites by special arrangement. Studios have also been installed in Oshawa and Sudbury, and further expansion is planned. Two-way point-to-point teleconferences are most common, but point-to-multi-point conferences can also be arranged.

Rather than aiming for a broadcast quality system, MGS installed a minimalist, functional system at a fraction of the cost of most video conferencing studios. In Toronto, several meeting rooms are wired for teleconferencing, and a portable unit containing monitors and a camera, an additional camera, and audio equipment are moved in as required.

The hardware cost about $25 000 per location. The only changes to the meeting rooms were the addition of high-intensity fluorescent lights and carpeting (for acoustics) at a cost of $3000. Transmission is via microwave. A one-hour video conference between Toronto and Thunder Bay costs about $280 an hour, the price of a return flight to Thunder Bay. In addition, monthly line charges total approximately $1000.

To minimize the obtrusiveness of the technology, a technician is available to set up and operate the cameras remotely. When privacy is a concern, cameras can be preset or participant controlled. For added security, the audio portion of the teleconference can be sent via the regular telephone network.

2.4/ Training and Promotion

In the early stages, it was clear that training and promotion would be key factors in determining success, particularly for audio teleconferencing. Building support for teleconferencing is a labour-intensive process. In 1980, the TEMP Teleconferencing Task Force, including representatives from the Ministries of Transportation and Communications, Government Services, and Energy, was created to promote the use of teleconferencing. This group has publicized the benefits of teleconferencing, provided consultation, and assisted with training and promotion throughout the government. Sessions were conducted to persuade users of the benefits of teleconferencing and its applications for them, to show them how to arrange teleconferences and use the equipment, and to teach them how to effectively conduct teleconferenced meetings. Senior management endorsed teleconferencing with memos and set an example by using it. Most recently, interest among managers has been generated because of budgeting constraints. Internal marketing through newsletters, brochures, posters, and slide shows was also used. Finally, personal selling, word of mouth, and live demonstrations generated interest.

2.5/ Usage

In some ministries, formal evaluation procedures have been put in place. Nevertheless, it is clear that within the Ontario government,

- total use exceeds 150 teleconferences per month,
- about half of the teleconferences replace conventional meetings (the other half are meetings which could not otherwise be held),
- only about 40% of potential users in government actually use teleconferencing,
- most ministries use some form of teleconferencing,
- a few ministries use teleconferencing extensively, and
- most ministries could use teleconferencing more.

2.6/ Evaluations

2.6.1/ Ministry of Transportation and Communications (MTC)

Teleconferencing was closely monitored over 18 months in 1979/80 [5]. Participants completed evaluation forms at the end of each session, and in-depth interviews were conducted at the end of the period. It is estimated that during the trial period $50 000 in travel costs and 2078 hours of management time were saved through the use of the CNCP dedicated network. Most conferences lasted two to two and a half hours, involved five to six locations, and had 15 participants. Over 88% of the teleconferences were thought to have replaced travel, and the rest were meetings that would not otherwise have been held.

A survey of users indicated that satisfaction was high. Many people who initially opposed the system became avid supporters. The most frequently cited advantages were time savings, cost savings, increased efficiency, and increased participation of regional staff who would not normally travel. Loss of face-to-face contact and non-verbal communication were the most frequently cited disadvantages. In addition, some users found that teleconferencing was not suitable for all meetings and that the additional preparation required was inconvenient. Still, 50% of users indicated that they were completely satisfied or very satisfied with the medium. An additional 47% were somewhat satisfied. (See Table 1.)

At MTC, teleconferencing has been used for a variety of purposes, including operations committee meetings between head and regional offices, affirmative action sessions, and other committee meetings.

2.6.2/ Ministry of the Environment (MOE)

From 1981 to 1983 use of audio teleconferencing at the Ministry of the Environment was evaluated [6]. Senior management estimates that travel has been reduced 30% using teleconferencing. MOE is relatively small but averages seven teleconferences per month. Almost half of the users recently surveyed felt that use could be increased. Only 43% of teleconferences are thought to replace travel, but this still represents a savings of over $2000 per month. Others viewed teleconferencing as a means of improving communications. Most meetings involve six or more locations

and 10 or more participants. Half of the meetings last one to two hours, but 29% are two hours or longer. Despite technical problems, the level of satisfaction is reasonably high. Over half of the users are "very satisfied." The advantages and disadvantages cited were similar to those mentioned at MTC.

The Ministry of the Environment system was implemented to help improve co-ordination of regional operations. Its applications have included weekly directors' meetings, committee meetings, and even a press conference.

2.6.3/ Telephone-Based Systems

Use of telephone-based systems is harder to measure but seems to be even more extensive. The Ontario government bridge is used over 100 times per month for teleconferences which, typically, last one hour and involve between three and nine locations [7]. Examples of ministry uses of this bridge include the following:

- The Ministry of the Attorney General has used the audio bridge several times for meetings between Crown Attorneys in Northern Ontario [8].

- The Ministry of Community and Social Services uses it on a weekly basis for various applications, including operations management meetings, regional meetings, and occasionally, for interviews conducted by French Language Services [9].

- The Ministry of Education uses teleconferencing several times a month for formal meetings and project co-ordination. Recently, for example, it was used to draw up and review guidelines for course curriculum [10].

- The Ministry of Intergovernmental Affairs has used teleconferencing to meet with its counterparts across the country [11].

- The Ministry of Energy, despite its small size, has also made good use of the medium. Its Federal/Provincial Bilateral Agreement Task Force members have met with their federal colleagues in Ottawa on a regular basis for project evaluations, information exchange, progress and status reports, and evaluations of proposals, using audio conferencing. It has also been used for a variety of committee and association meetings [12].

- The Ministry of Health also uses audio conferencing on a monthly basis for administrative purposes. Add-on devices and speakerphones are used regularly [13].

- The Ministry of Natural Resources has the most extensive audio system in the government, with about 16 Conference 2000s located in its regional and district offices. These are used several times a month for regular administrative meetings between head, regional, and district offices, but also for solving problems, for information

distribution and exchange, and for communications with individuals out in the field [14].

- Other ministries have used the bridge on an occasional basis.

2.7/ Promotional Programs

2.7.1/ TEMP Teleconferencing Task Force

Originally established to promote the use of teleconferencing within the government, the mandate of the TEMP Teleconferencing Task Force was expanded to include the private sector. In Ontario, use of teleconferencing in 1980 was very limited, and most suppliers were unconvinced of its potential. However, as teleconferencing offered considerable benefits in terms of energy savings and improved productivity, the government was determined to expand its use [15].

2.7.2/ Approach

The TEMP effort is aimed at stimulating both the supply and demand sides of the market. TEMP provides information, demonstrations, training, and implementation assistance to users. Demonstration projects have been established with Polysar, a petrochemical company, and the University of Ottawa. Bell Canada was also encouraged to establish an internal teleconferencing project to assess the benefits of teleconferencing. In addition, suppliers are assisted in developing and testing new products and services. Finally, the task force researches use, applications, and techniques of teleconferencing, and recently conducted a survey of teleconferencing use in Ontario.

2.7.3/ Achievements

Information on teleconferencing has been distributed to over 4000 organizations in the province. Numerous seminars and a major conference attended by over 250 people have been held. TEMP encouraged Bell Canada to establish an internal demonstration, which proved very successful [16], and a wide range of services are now being actively marketed.

In 1980, following several pilot projects that demonstrated the usefulness of teleconferencing for health care and education, the Ontario Ministry of Health established its Telehealth program. Working with MGS and various health-care institutions, the Ministry of Health promotes the use of telecommunications in the health sector by providing information, consultation, and funding. The principal application of teleconferencing is the provision of continuing education for health-care professionals. In addition, it is used for administrative purposes and, in some instances, for patient care.

3/ OTHER PROVINCIAL GOVERNMENTS

While the Ontario government appears to have one of the most extensive teleconferencing programs in the country, other provinces are also

utilizing the technology. Many, however, have only recently installed systems and have not yet evaluated the results. Few have established policies specifically on teleconferencing.

New Brunswick
The province of New Brunswick leases a 10-point conference bridge from NB Tel, which is made available to all ministries. The system is used approximately six to eight times per week. Although there is no official promotional program, NB Tel markets its teleconferencing services to government staff, also advising them of the availability of the conference bridge. Telephone bills are monitored to identify conference calls which could have been conducted using the bridge [17].

Newfoundland and Labrador
The government has recently completed a joint study with Newfoundland Tel. To promote teleconferencing, the telephone company provided the government with Conference 300 bridging service free of charge for a trial period. Some freeze-frame technology was also made available. The results of these collaborative efforts are not yet known [18].

Nova Scotia and P.E.I.
As far as we have been able to determine, teleconferencing is not used extensively by the Governments of Nova Scotia or P.E.I.

Quebec
Recently the Government of Quebec installed Centrex 3, with a conferencing feature that can accommodate up to six people. To date there has been no official policy or promotional program established. In addition, the government has access, free of charge to a full-motion video system linking Montreal to Quebec City. It is used three to four times each week for groups of four to six for a variety of applications [19].

Manitoba
The province of Manitoba is using both audio and video conferencing for a variety of purposes. At present, Manitoba Telephone is promoting use of its products within the government, and some departments are using conference calling and group terminals. In addition, a full-motion video system links Winnipeg with the psychiatric facility in Brandon, Manitoba. It is used primarily for evaluating patients. An experiment using Telidon in the Department of Agriculture is also under way [20].

Saskatchewan
While there is no active promotion or monitoring of teleconferencing in the Saskatchewan government, audio conferencing is being used. Currently, there are several Darome bridges, rented from Sask Tel, and in May 1985, a DMS 100 switch with conferencing capability will be installed in Regina and Saskatoon [21].

Alberta
Again, although the Alberta government has no official policy on teleconferencing, many departments use audio conferencing to some extent. Recently, a DMS II with conferencing capability was installed, although

little use of it has been made to date. Telecom Canada's video conferencing centres in Edmonton and Calgary are also used [22].

British Columbia
The province of British Columbia, with the assistance of B.C. Tel, is promoting teleconferencing internally, using an approach based on that of TEMP. Two Conference 300 bridges, each with 10 ports, are being used extensively. In January 1985, there were 30 conference calls [23].

Northwest Territories
Given the problems posed by distance and weather, it is not surprising that teleconferencing is being used extensively by the Government of the Northwest Territories. PBXs with bridging capability are most frequently used to establish conference calls. Many senior managers have speakerphones, and there are several Conference 2000s in place. There is little formal promotion or evaluation, but the system is used regularly [24].

4/ THE FEDERAL GOVERNMENT OF CANADA

The Government Telecommunications Agency (GTA) provides teleconference bridges across the country for the use of federal government departments and agencies. In addition, many telephone systems have three-party add-on and six-party conference features. On average, the Ottawa bridge alone averages about 20 to 30 conferences each week, and use has grown steadily. In addition, most departments have group audio terminals. Some departments also use dedicated networks. Applications of teleconferencing include periodic management meetings, information exchange, updates, and crisis management.

The GTA has also embarked on trials using other forms of teleconferencing. From November 1983 to February 1983, conference rooms in Moncton and Saint John, New Brunswick; Halifax, Nova Scotia; St. John's, Newfoundland; and Ottawa were equipped with Conference 2000s, black and white freeze-frame, Telidon display terminals, and a facsimile machine. Fifteen demonstrations were conducted and attended by approximately 400 people. Of these, 49 returned questionnaires assessing their attitudes to teleconferencing:

- 52% indicated that they had previously participated in audio conferences; 11% had been involved in video conferences.
- Most felt that teleconferencing could reduce travel -- 71% felt that at least 20% of meetings could be replaced, and 18% felt that as many as 50% of meetings could be avoided using teleconferencing.
- About 80% felt that all three systems (audio, Telidon, and freeze-frame) were easy to use.
- The quality of the systems was perceived to vary. About 65% felt that the audio was good or excellent, more than 50% felt that freeze-frame was good or excellent, but 90% felt that Telidon was good or excellent.

- Howard Macumber, Manager of Engineering for GTA, emphasized that these perceptions about quality did not translate into preference. Voice was perceived as the most essential component, freeze-frame was next in importance, and Telidon was though to be the least useful of the three. About 57% felt Telidon could be used in no more than 10% of meetings, whereas a few (8%) felt it could be used in more than 60% of conferences. In contrast, 66% felt that freeze-frame could be used in at least 20% of conferences.

- In general, respondents felt that it would be slightly inconvenient to have to travel to another building to participate in an enhanced teleconference. Although 15% said it would not be inconvenient, 51% said it would be slightly inconvenient, 12% felt it would be very inconvenient, and 22% said they would hold a voice-only conference to avoid travel [25].

Since the trial, GTA has been exploring other teleconferencing media. Currently they are working on developing a satellite network, which may, among other things, be used for video conferencing. In addition, in September 1985 they plan to offer an office communications system which integrates voice, text, and data [26].

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Table 1/ Evaluations

Advantages (more than 1 answer allowed)	MTC 79/80	MOE 80/82
Eliminated travel	77	89
Enable more staff to attend	38	49
Meetings took less time	51	47
Reduced number of phone calls	14	35
Reached decision more rapidly	32	27
Disadvantages		
Loss of personal contact	23	76
Equipment/transmission problems	7	40
Meetings require more preparation	9	18
More tiring than face to face	9	16
More time to complete business	?	6
Level of Satisfaction		
Completely satisfied	7	5
Very satisfied	43	52
Somewhat satisfied	47	39
Somewhat dissatisfied	3	2
No response	1	2

Usage	MTC (18 mth.)	MOE (26 mth.)
Total teleconferences	86	189
Travel substitution	88 %	43 %
Avoided costs: travel	$48 929	$31 572
time	$37 071	$23 965
	$86 000	$55 537

PART 7/

TELECONFERENCING IN HEALTH

1/ INTRODUCTION

Telemedicine, or telehealth, has been defined as "situations in which health-care professionals use telecommunications channels to communicate with each other or their patients, with the goal of improving, in some way, the delivery of health-care services."[1] Scattered experiments in telemedicine were conducted in the US in the first half of the century, but a determined effort was not made to use the technology until the 1960s. In Canada, serious experiments began only in the late 1970s, with telemedicine use passing the experimental stage only in the 1980s.

Experiments with all forms of teleconferencing -- audio-only, slow-scan video, two-way interactive video, one-way video with two-way audio -- have been conducted, and all forms are in use somewhere in Canada. Although audio conferencing is the most widely used because of its flexibility, low cost, and ability to link multi-sites easily, other technologies, such as slow-scan or freeze-frame video, are gaining in serious consideration. Special-event or point-to-multi-point video conferences for teleducation are also becoming more widely known and used.

With its vast and sparsely populated geographical areas and a commitment to maintaining high standards of health care, Canada is an excellent country for experimenting with and developing telemedicine projects and services. The federal Department of Communications instigated and encouraged the initial experiments, using the Hermes satellite in the late 1970s and, shortly afterwards, Anik B. These telehealth experiments took place primarily in Newfoundland, Quebec, and Ontario, linking an urban centre with a remote northern area. Teleconferencing -- audio, in particular -- is now used not only to link remote areas but also to connect busy health-care professionals in the central or populated areas of Canada.

To understand the development of telemedicine in Canada, it is important to consider both the technology used and the applications of the systems. Part 7 provides a brief discussion of these two areas. Readers wishing more detailed information are advised to consult the works listed in the bibliographies of A Canadian Telehealth Sourcebook by J. Picot and J. Roberts or Evaluating Telecommunication Technologies in Medicine by D.W. Conrath, E.V. Dunn, and C. Higgins. The Sourcebook also lists contact persons for each of the major projects in Canada.

2/ TECHNOLOGY

2.1/ Audio

Audio teleconferencing is currently being used in the health-care field from B.C. to Newfoundland. Its versatility, combined with the almost universal access to the telephone, make it a valuable tool for maintaining health care in parts of Canada where the population is sparse and distances are great. Although audio teleconferencing is primarily employed for purposes of administration and continuing education, it is now being used in various parts of Canada for credit courses, mainly

because it has been recommended that nurses beginning practice, by the year 2000, have a B.Sc. in Nursing. For example, audio conferencing is used as a primary mode of delivery at the British Columbia Institute of Technology (BCIT), Ottawa University, the University of Western Ontario in a joint course with the University of Waterloo, and Grant McEwan College. The University of Victoria has used audio conferencing through a 10-port Wescom bridge to conduct seminars in a post-basic B.Sc. Nursing course in community health.

Newfoundland

Although teleconferencing for health-care purposes (telehealth or telemedicine -- both terms are used interchangeably here) has only begun in most parts of Canada since 1980, the Faculty of Medicine at Memorial University in Newfoundland initiated audio conferencing in the late 1970s. By 1980, 13 communities in the province were linked with a number of sites in St. John's, via the first dedicated, four-wire, ground-based teleconference system in use in Canada. Early in 1981, province-wide expansion began, to include about 40 sites and 70 buildings by the spring of 1983. Every hospital in the province, some government buildings, a nursing home, university buildings, and seven vacation schools became part of the teleconference network. This system has now become a significant part of health and education activities in the province [1,2]. The university has a dedicated fully duplexed four-wire system with an on-site bridge and Darome conveners at the sites.

In 1982, Memorial University co-operated with the Toronto General Hospital (TGH) and the Royal College of Physicians and Surgeons of Canada to establish a joint teleconferencing project to "explore the use of interactive audio in the health-care system" [3]. A 20-port Darome bridge was purchased, and Darome conveners were installed in 16 medical schools and some teaching hospitals. The system was used for administration and continuing medical education (CME), with all provinces and territories taking part in both provincial and regional teleconferences [1].

The Newfoundland Ministry of Health uses teleconferencing as well, for administrative purposes.

Ontario

Although the Royal College/TGH Joint Teleconferencing Project has come to end, CME is still offered throughout Canada. In Ontario, the Telemedicine for Ontario project continues from the Toronto General Hospital, with the Darome bridge now jointly owned by the hospital and Darome. At the Northeastern Ontario Telehealth Network in Sudbury, Ontario, an audio-conferencing bridge, which can link up to 20 locations simultaneously, has been installed and will be used primarily for conferences within the region, though it is capable of connecting sites anywhere in the world [4]. The bridge is used to redistribute programs offered from the Telemedicine for Ontario project and for programs using local resources.

The Ontario Ministry of Health uses teleconferencing also, for administrative purposes.

British Columbia

The University of British Columbia medical school does not own a bridge but has access to those in other Vancouver institutions and the Knowledge Network of the West (KNOW). Teleconferences are sometimes held after KNOW broadcasts in CME. The B.C. Health Association, which uses teleconferencing for professional development, is proposing to put in a large bridge.[2] In 1983, a trial series of audio-teleconferenced lectures was given, which will be compared to previously evaluated televised lectures to note any differences in the effectiveness of the media. However, audio teleconferencing will likely be used over the next few years in British Columbia for most health distance education because of its cost effectiveness [1].

The Prairies and Northwest Territories

Both the University of Alberta and the University of Calgary use Darome bridges with Darome conveners. The University of Alberta has been using audio conferencing for CME for approximately four years. It began with a pilot in 1980 using Alberta Government Telephone bridging services and speakerphones in 15 hospitals. The University of Calgary began trials in 1981 and since then has delivered "professional health education to over 40 hospitals" [5]. The Alberta Hospital Association has now set up an extensive teleconference network to link all its members for continuing education.

Trials in the form of summer research projects (1978, 1982) were undertaken at the University of Saskatchewan's Faculty of Medicine with positive results. The university has now "received funding from the Max Bell Foundation to co-ordinate a consortium of health agencies in their use of dial-up teleconferencing for professional education" [5].

In the Northwest Territories, physiotherapists, who are few and scattered over a large area, use teleconferencing to update information at headquarters while they are travelling.

Quebec

The four medical schools and approximately 15 hospitals in Quebec participate in occasional teleconference sessions, presenting lectures for CME. Use of telephone lines to transmit ECGs to Sacré-Coeur hospital in Montreal began in 1971. The telephone is now used for consultation and teleconferencing between physicians in Ville Marie and specialists at Sacré-Coeur and discussions among nurses at the two hospitals [1].

Maritimes

Audio conferencing is also used for CME at Dalhousie University. In 1983, a five-month trial was undertaken in Western New Brunswick, linking eight hospitals through an N.B. Tel bridge and Darome conveners. The bridge is rented and now links 14 sites for professional health education [1,5]. The New Brunswick Hospital Association is renting a 22-port bridge for the purposes of professional health education and administration.

2.2/ Video

Most "Canadian telemedicine projects were initiated as a result of the federal Department of Communications Hermes Satellite Program" [5]. Some of these projects have become historic experiments; others remain as services for health delivery and education.

Between October 1976 and February 1977, the first Hermes experiment in telehealth took place, linking Moose Factory General Hospital to the Health Sciences Centre at the University of Western Ontario in London. One-way video was sent from Moose Factory to London, with interactive audio linking the two sites and a nursing station in Kashechewan, approximately 220 km north of Moose Factory. Remote-controlled cameras were installed in the Moose Factory hospital in a consultation room, in the X-ray department, and in an operating room and case room [1,5]. The system was used for consultations between physicians and specialists and for transmission and interpretation of X-rays and fluoroscopic films, at the same time allaying feelings of professional isolation. The system worked well technically, resulting in high-quality audiovisual communications and minimal downtime [6].

In 1977, the Health Services Centre at Memorial University was linked via the Hermes satellite to affiliated hospitals in St. John's and the four hospitals in Stephenville, St. Anthony, Goose Bay, and Labrador City. Over a period of three months, one-way video was sent from St. John's, with two-way audio linking all sites. Experiments with slow-scan video were also undertaken between St. John's and Labrador City.

One hundred and fifty hours of programming were completed in continuing education for physicians, nurses, and other health-care professionals. The service was also used for administrative and committee meetings, as well as for a limited amount of consultation services and transmission of medical data. The main objective "was to assess the value of the telecommunications system for continuing education (and to a lesser degree, for patient care)...." [1]. The system was considered a success, but prohibitively expensive. Most activities could be conducted using much less expensive audio and supplemented audio techniques [1].

An Anik B satellite experiment was undertaken in the late 1970s. The University of Montreal's project, "La télémedicine au Quebec: Liaison entre le complexe la Grande et Montréal par le satellite Anik B," used two-way black and white video between April 1979 and August 1979 to link Montreal and James Bay. A second phase in 1980 used slow-scan television. Both systems were used for teleradiology, teleconsultation, and medical teleducation [5].

Using the Anik B satellite, the University of Western Ontario undertook a six-week experiment in August/September 1982, to link the University Hospital with one-way video to the North Bay Psychiatric Hospital and with two-way interactive video to the Sudbury-Algoma Hospital. The psychiatric series, using both seminars and some patient presentation, was a success but was discontined [1].

Although most of the satellite experiments in telehealth were discontinued because of the high costs of maintaining the service, interactive video is still used in parts of Canada for health care. The Moose Factory/London, Ontario project led, in 1980, to an established microwave link between the University Hospital in London and Woodstock General Hospital (47 km away). Called the Interactive Telehealth Project, the two-way fully interactive colour video was originally conceived "to meet a paramount need for psychiatric services for the people in Woodstock" [6]. Since this need has been met in other ways, the system is now used for continuing education, administration, and, to a limited extent, teleconsultations. An average of 10 hours of live programming is conducted a week. St. Joseph's hospital in London has been added to the system, and further sites may follow [5].

Since 1976, two dedicated broadband channels have provided an interactive video link between the Health Sciences Centre teaching hospital of the Faculty of Medicine at the University of Manitoba in Winnipeg and the teaching hospital in St. Boniface. One channel is used 26 hours per week for undergraduate and graduate medical education: seven hours for lectures and question sessions with staff and visiting professors; and the remaining hours for medical rounds, clinical conferences, and interdepartmental case presentations. The second channel, used on a daily basis, transmits ultrasound images for medical consultation [1]. A third link, established on a three-year contract at the Brandon Mental Health Centre, is currently used 20 hours a week.

The University of British Columbia's medical school has access to one-way video and two-way audio through the Knowledge Network of the West (KNOW), which uses a hard-wired cable network, linking the five Vancouver teaching hospitals, for professional education, patient care, and administration. Also used for these purposes is KNOW's private video network, serviced by satellite, throughout the province [1]. Since the fall of 1981, the Division of Continuing Education in the Health Services has been producing a series of live interactive television programs in CME for the participating B.C. hospitals. The programs, usually a lecture followed by an on-air discussion, are offered in the fall and spring, on five or six consecutive week nights, for one to two hours an evening. Since the spring of 1983, the participants have been able to phone questions into the lecturer and to teleconference after the program was off the air [1]. The Division of Continuing Education also has plans to experiment with ad hoc or special-event video teleconferencing through KNOW.

Cable television is also used in Quebec for professional health education but without interaction.

The Northeastern Ontario Telehealth Network (NOTN) established a pilot project with the local cable company, using one-way video from Elliot Lake and Espanola to Sudbury. The results of this project are not yet available.

Drug companies sponsored, in 1981 and 1982, two national three-hour ad hoc video conferences for CME. These were attended by most medical schools [7]. Special-event video conferences in CME have been produced through Greenlignt Production and the Canadian Teleconference Network (CTN), Toronto consulting companies specializing in ad hoc video conferences.

For example, in 1983 over "300 specialists in gastroenterology and therapeutic endoscopy from around the world gathered at Toronto's King Edward Hotel...to participate in the world's first live two-way teleconference on the subject. A mile from the hotel, at the Wellesley Hospital, which hosted the educational event, doctors with special television cameras attached to their endoscopic fibre-optic probes, relayed live colour pictures of their patient's oesophagus, stomach, colon, and so on, while discussing their procedures with the hotel audience" [8].

The two-way full-motion video services of the Ontario government is sometimes used for psychiatric interviews between patients in Thunder Bay in northern Ontario and doctors at the Clarke Institute of Psychiatry in Toronto.

2.3/ Slow-Scan Video

Although the experiments with video satellite teleconferencing for health care were successful, the cost of maintaining such services was prohibitive for many institutions, and cheaper or more versatile systems have been sought. In some places, slow-scan video has proven to be a system that meets the needs adequately. For others, such as the Universite de Montreal's links between Montreal (Sacré-Coeur hospital, Hôtel-Dieu hospital, and the Institut de Génie Biomedical) and James Bay (Le Centre Hospitalier de la Grande Rivière), a "slow-scan system was used to replace the satellite communications but was not found to be worthwhile, and at present, a telephone link only is maintained" [1]. The Dr. Everett Chalmers Hospital in Fredericton, New Brunswick experimented with slow-scan or freeze-frame television but does not have a permanent system.

The Department of Ultrasound at the University of Manitoba's medical school uses audio and freeze-frame teleconferencing for patient care and professional health education [5]. Its primary link is to Victoria Hospital in Winnipeg, but a link has also been made on occasion to Sioux Lookout in northwestern Ontario. Plans exist to introduce the system in The Pas as well. In Ontario, NOTN plans to add slow-scan systems to its audio network to link outlying locations to Sudbury.

Two pioneering experiments with slow-scan video led to two different results. In 1977, slow-scan was used between St. John's Newfoundland and Labrador City, in conjunction with the Hermes satellite video experiments. The service was not continued. In 1979, another experiment was undertaken with Anik B. The Health Sciences Centre in St. John's was linked to three Labrador communities (audio only) and an offshore oil rig, the PetroCanada drill ship EDDRILL-II. A four-wire teleconferencing

unit and NVI slow-scan television equipment allowed the medic to transmit X-rays and other still pictures from the medical clinic (sick bay) to the Health Sciences Centre [9]. Because of technical problems, the St. John's to EDDRILL-II part of the project was cancelled. A second trial began in September 1983, providing the sick bay with teleconferencing, slow-scan television, and electrocardiogram (ECG) transmission units. Audio consultation between the rig medic and emergency physicians was conducted using the four-wire channel as a voice link, supplemented by medical data transmission as needed. The medic and rig technical personnel participated in transmissions, including X-rays and ECGs, and demonstrations of the system [9]. One of the conclusions drawn at the completion of the project was that "slow-scan (freeze-frame) television can significantly enhance the capacity of voice links in the support of health care" [9].

The more successful of the two projects and the only long-running continuous use of slow-scan video for health care in Canada was started in 1977 in Ontario following a period of comparative testing. Dr. David Conrath (University of Waterloo) and Dr. Earl Dunn (Sunnybrook Medical Centre) researched the use of telecommunications in remote health-care delivery, comparing two-way colour TV, two-way black and white TV, simple telephone, and slow-scan video. Once it was determined that slow-scan video was as effective as full-motion video, it was decided to install the more cost-effective system. As a result, eight locations were installed with Colorado Video slow-scan equipment. Two teaching hospitals in Toronto (Sunnybrook Medical Centre and the Hospital for Sick Children) were linked to Sioux Lookout Zone Hospital, 1500 km northwest of Toronto, which, in turn, was linked to three nursing stations (New Osnaburgh, Sandy Lake, and Big Trout Lake), each approximately 400 to 500 km away. Two health-aid stations, at Deer Lake and Kasabonika, were also linked to this network. The Sioux Lookout Zone covers an area of 385 000 km^2, with 10 000 people in scattered communities. Apart from the hospital in Sioux Lookout, there are seven nursing stations and 20 community health-aid stations in the 27 remote communities in the zone. Each of the eight chosen locations was equipped with a black and white video camera with zoom lens, a transceiver, a modulator/demodulator, a send monitor, a receive monitor, a Bell Canada speakerphone, and a telephone data coupler. The three hospitals also have two extra store monitors so that three images can be consulted simultaneously.

The hospital units can store transmission on audiotape for further consultation or continuing education. The Colorado Video equipment is used with a resolution of 256 x 512 pixels and 64 shades of grey. The image is transmitted in 78 seconds, using regular dial-up phone lines. The system is most often used for transmission of X-rays from a nursing station to the Zone Hospital. Since May 1978, continuing education has also become an important aspect of slow-scan transmission.

2.4/ Electronic Graphics

To date, few experiments with other forms of electronic graphics have been undertaken. The University of Calgary has a Telidon link to one of

the city's hospitals, which has been used only once or twice for in-service training for doctors and nurses. Nurses in post-RN degree programs in the Ottawa region, however, can receive courses via teleconferencing from the University of Ottawa, using the Electronic Blackboard for course delivery.

3/ RANGE OF APPLICATIONS

Although the various areas of health care are interlocking, they fall roughly into the following categories:

- health-care delivery (remote consultation, diagnosis, and treatment);
- education for health-care professionals;
- social-therapeutic services; and
- administration. [1,5]

All three types of teleconferencing systems have been used for these areas.

3.1/ Administration

Audio conferencing, which has proved to be a versatile and relatively inexpensive means of conducting committee meetings or keeping dispersed health-care workers up to date on activities, is the method most used for administration. It was used by the Royal College of Physicians and Surgeons for business meetings during its audio project, and groups such as the Northeastern Ontario Telehealth Network (NOTN) or the Alberta Hospital Association find it beneficial because their members are scattered across a large geographical area.

3.2/ Social-Therapeutic

Uses of telehealth in this category are still quite limited, but the great potential for a support system to health-care workers or their patients in remote or isolated areas is great. The Sioux Lookout system, for example, is used 25% of the time in this way. Audio conferencing alone, or with slow-scan video, is used at times, to alleviate feelings of alienation and confusion which result when non-English-speaking native peoples are separated from their families for medical treatment, which can retard progress of the treatment.

3.3/ Health-Care Delivery

Although, in most cases, this was the primary intention of a telemedicine project, direct delivery of services is still limited. The institutions owning slow-scan video systems generally use them for the transmission of X-rays, electroencephalograms (EEGs), or electrocardiograms (ECGs). This system, however, has also been used to transmit skin rashes, burns, microscopic slides (for example, in haematology), physiotherapy slides, dental pictures, and pictures of such parts of the body as the eyes.

Full-motion video systems are used for psychiatric services by the Winnipeg/Brandon Mental Health Centre and, occasionally, by the Clarke

Institute of Psychiatry, using the Ontario government's link between Toronto and Thunder Bay. The Woodstock/London system was initially intended for psychiatric use but is predominately used for medical education.

3.4/ Education

The most frequent and widespread use of teleconferencing in the health-care field is in the realm of education, both for credit and in continuing professional education. Continuing medical education (CME) has been offered in all parts of Canada by means of audio, slow- scan, two-way video, one-way video/two-way audio, or the Electronic Blackboard. With constant changes and developments or discoveries in medicine and other health areas, health-care professionals are under constant pressure to "keep up" and seek continuing education. Until the advent of telemedicine and teleducation, those practising in remote areas of the country or away from urban centres had little opportunity to do so.

The continuing education departments of virtually all medical schools in Canada undertook some continuing education by teleconference [3] during the Royal College of Physicians and Surgeons/Toronto General Hospital (TGH) project. Such education may be provided by full-motion video, as it is between the University of Manitoba's two teaching hospitals or between London and Woodstock, Ontario; or by audio only, as it is in such places as Memorial University in Newfoundland or the University of Calgary, where over 40 hospitals have received programs. Judy Roberts describes the University of Calgary's programs as follows:

> The CME Division offers a one-hour CME program every two weeks. Each program is repeated a second time so that different groups of hospitals may participate in each session, a high level of interaction can be encouraged, and the 20-site capacity of the bridge is not exceeded. Between 13 and 17 hospitals dial in for each program. While most hospitals are located in southern Alberta, the hospitals in Fernie and Kamloops also participate. This program is designed by the Faculty of Medicine for physicians; however, a large number of nurses also participate. Generally, between 150 and 200 health professionals receive each program. [7]

Telehealth continuing education in Alberta is extensive. Apart from the University of Calgary's activities, the University of Alberta's programs have been in existence for approximately four years. The Alberta Hospital Association offers 400 hours of educational programming a year and has 93 hospitals on its network. Similar education is being provided by the B.C. Health Associations and the New Brunswick Hospital Association.

A common format of an audio conferencing program would be a one-hour lecture with question and answer, using pre-circulated handouts or slides. Roberts et al give the formats for The Telemedicine for Ontario's CME programs as "journal club," "regular hospital departmental rounds," "radio hot line," and "a panel of resource people," with topics

ranging from general interest sessions to more specialized programs such as "The Critically Ill Patient" [10].

The Sioux Lookout project blends education and patient treatment, using lecture format or discussion from case presentation. For example, a "request for a medical consultation is used as a topic for a review of the patient and of the topic in general" [11]. Therefore, current cases are covered, and X-ray and medical rounds covering, for example, cardiology and haematology, are common. Programs are conducted weekly for both doctors and nurses. Dunn and Fisher describe the programs at the Sioux Lookout Zone Hospital:

> The first educational programs presented on the slow-scan system were radiology rounds. These started in May 1978. Each week the doctors in the Zone Hospital would select several difficult cases for discussion with a radiologist situated in Toronto, 1500 km distant. Discussion occurred on one telephone line, while transmission of the X-rays was occurring on the other phone link. During a one-hour program, six to eight patient problems would be discussed, with as many as 25 to 30 views transmitted. Although these sessions were called educational, in fact, in approximately 50% of cases, patient management changes occurred. [11]

With the continuing need for CME and growing demand for services in remote areas, teleconferencing use will increase. The relatively low cost of both audio and slow-scan video conferencing make them useful tools where budgets are tight, areas are vast, and residents and health-care workers are widely scattered. As transmission costs drop, full-motion video, whether two-way interactive or ad hoc, may become more feasible in areas where movement and natural colour are essential.

4/ CONCLUSION

The previous discussion is not meant to be all inclusive; the field is developing rapidly. Rather, it presents an overview of the experiments and attempts to improve health care throughout Canada through the aid of teleconferencing systems.

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PART 8/

TELECONFERENCING IN EDUCATION

1/ INTRODUCTION

Although distance education in the form of correspondence courses has existed in parts of Canada since the last century, teleconferencing as a means to deliver or supplement courses has been a regular part of distance education for less than a decade. In most universities and colleges it has been familiar only since 1980. Using technology, such as radio or television, for delivery of courses dates back to the beginning of these media, but the interactive element which characterizes teleconferencing has emerged only in the last few years [1,2,3].

Experiments using interactive audio with satellite or microwave began in various parts of Canada in the mid-1970s [1,4]. In spite of such experiments and recent interest in other media, such as Telidon, slow-scan video, Electronic Blackboards, and computers, audio-only teleconferencing still predominates as the most cost-effective and flexible mode of teleconferencing to assist in the delivery of educational programs to students who are unable, or choose not, to attend regular in-class courses at educational institutions.

Worldwide technological changes have encouraged the development of teleconferencing use within educational institutions and created new categories of learners, needs, subject matter, and educational purposes [3]. The new technology has also created new opportunities and media for creative educators and learners. However, the push has not come entirely from positive factors. Budget constraints have forced many institutions to rethink distance education programs, which traditionally involved travelling faculty or teachers. The minimum number of students needed in a course to send a professor to a remote site is rising rapidly because of cost, lack of professors, and fewer professors willing to travel. Also, in the past five or 10 years, the clientele has become much more diverse, resulting in a need for a wider variety of courses and more specialized ones. To maintain the commitment to the off-campus communities, universities and colleges have turned to teleducation, or teleconferencing [5]. A need for new educational opportunities, and increased pressure on faculties of part-time education, is created by shifting and mobile populations; growing numbers of working women, handicapped, and senior citizens, who wish continuing education; the rising educational level of the population; increased leisure time and longevity; changing life-styles; and the use of "entitlements" among "old" and "new" minorities [1].

Making courses available for professional upgrading in such areas as teaching and health care is becoming increasingly important. Other professions are also seeking ways to keep their members current with developments in the field. Nursing, however, is in the forefront of professional development. Since, by the year 2000, nurses will be required to have a Bachelor of Nursing Science, many nurses without this degree will want to upgrade their standing immediately. Retraining through full-time attendance at university will be impossible because most of them work [5]. Various universities and colleges across the country are now offering distance education programs in nursing and other professions.[1]

With the rapid changes in technology and society, more adults will require retraining [6]. New types of students and changing emphases in pedagogy are shifting the demand to more interactive, student participatory learning experiences and a desire to add a personal element to those distance education courses which are primarily self-directed and print-based. As part-time and continuing education programs expand, use of teleconferencing, particularly audio, will also increase as it becomes more widely recognized as one of the cost-effective and efficient modes of course delivery or supplementation.

Mount Saint Vincent University's DUET represents a typical attitude to meeting modern learner needs, making the resources of the university available to the business community, using cable TV and video teleconferencing [7]. Teleconferencing will assist universities and colleges in meeting their commitment to the community at large. It is effective where education must be dispersed over a wide geographical area, where there is no instructor to travel or no money to send one, where students are too few for a class or want specialized courses, and where communication beyond print is desired.

2/ WHO IS USING IT

Throughout Canada's 9 992 330 km^2 are scattered over 60 universities, more than 200 colleges, and many other educational institutions. Most of these institutions are located in urban centres, but many of the students who need or desire education are not. Studies reveal that more than 30 universities and more than 12 colleges and institutes of technology use, or have experimented with, some form of teleconferencing. Others report that they are planning to use it [1,2,3].[2]

Since the mandate of many community colleges is more limited in geographical scope than most universities, distance education has not been a priority or service for most. Sheridan College in Ontario, for example, introduced a course on teleconferencing in January 1985 as part of its media arts program, and it has been involved in special-event teleconferencing. Sheridan does not, however, use teleconferencing as means of course delivery. Teleconferencing within colleges is most extensive in areas where the population is scattered and the service area is geographically wide; for example, Confederation College in Ontario covers a geographical area of 557 000 km^2. The Open Learning Institute (OLI) in B.C. and the Kelsi Institute of Applied Arts and Science in Saskatchewan also cover vast areas.

Dr. D. McDonell gives the number of post-secondary courses being taught by teleconferencing as 97 in 1983 [5]. Although figures are not available for 1984, the number has risen and is expected to continue to rise. Some institutions have used teleconferencing only occasionally, whereas others maintain it as an integral part of their distance education program (e.g., University of Calgary, Athabasca University, University of Ottawa, Acadia University, and Memorial University). Teleconferencing may be a primary means of delivery (e.g., Red Deer College, University of Western Ontario, University of New Brunswick, and University of Ottawa)

or a support system for another delivery mode such as print or television (e.g., Confederation College, Ontario Institute for Studies in Education [OISE], Dalhousie University, Télé-Université de Quebec, University of Victoria, and Athabasca University). Most institutions link only a few sites within a single teleconference; at times the link may be only two points. A few offer courses to a large number of locations which may be connected in various combinations:

- Athabasca University offers courses to 30 centres in Alberta, Saskatchewan, and the Northwest Territories;
- the University of Calgary has links to over 50 sites, including colleges, education centres, and hospitals throughout Alberta; and
- Memorial University's system links all universities and hospitals in Newfoundland and Labrador.[3]

3/ RANGE OF USES

Teleconferencing has become a means of delivery or a support system in three areas of distance education: credit courses, non-credit or continuing education, and administration.

The range of courses offered for credit is considerable, but the specific offerings vary from year to year depending upon the needs and demand of the student body. Most common are courses in education, business, humanities (film, English literature, philosophy, history, and religion), and social sciences (psychology, sociology, and political science). Four universities or colleges have offered courses in mathematics, accounting, statistics, or economics; another four have had courses in gerontology, child care, or social work. Science courses are rare, primarily because of the practical lab work, but several institutions have courses in computer science. Engineering courses may be taken at two universities, and one has offered a course in law and banking. Seven universities and two technical institutions give courses for nurses, and one offers courses for pharmacists. Colleges also offer courses for library technicians, medical laboratory technicians, and in air conditioning, motor mechanics, industrial hydraulics, and ambulance and emergency care.[4]

Continuing medical education (CME) courses are offered by a number of universities and colleges.[5] As well, the University of British Columbia (UBC) has offered courses for accountants, lawyers, engineers, dentists, and land surveyors; and the University of Saskatchewan, for veterinarians. Non-credit courses cover those directed at women's issues, senior citizens, secretaries, or those working with the developmentally handicapped, as well as training and development for specific professions.

The diversity of continuing professional education can be seen in the use of the DUET system at Mount Saint Vincent University (MSVU). It is used by the Atlantic School of Theology to provide continuing education for clergy throughout the Atlantic region; it will be used by representatives of tourism and hospitality industries, who already provide non-credit courses in hospitality, to provide credit courses in a proposed tourism and hospitality program to be launched within the year [8].

Video conferencing has also been used by the Law Society of Upper Canada in their bar admission course. The Law Society is also using computer conferencing for a continuing education course "The Rules of Civil Procedure." Acadia University also invites various professional groups to use their four-wire dedicated system and offers courses for teachers and business people.

4/ TECHNOLOGY USED

In the past few years, educational teleconferencing has moved from use of the telephone only to the use of very sophisticated technology by some institutions. However, most institutions still rely on the telephone network as the most economical and flexible system.

Of the universities and colleges reporting teleconferencing activity, over 12 have now purchased their own teleconferencing bridge [1,2]. Two are found in B.C. (British Columbia Institute of Technology (BCIT) and Knowledge Network of the West). The University of Victoria, which experimented with a bridge, now uses that of Knowledge Network. Athabasca University and the University of Calgary both own Darome bridges. Another bridge has been installed in Calgary at the Southern Alberta Institute of Technology (SAIT). Alberta's community organizers and students have overwhelmingly accepted teleconferencing as a method of course delivery:

> In fact, this year, many educational consortia in the province have installed automatic teleconference bridges and specially conditioned long distance telephone lines to service their area. To date, teleconference bridges have been installed in Drumheller, Bonnyville, Peace River, Hinton, Grand Prairie, and Blairmore. These bridges are linked to the SAIT bridge by a long distance call. [9]

The following universities all own private bridges: New Brunswick, Manitoba, Western Ontario, Ottawa, Télé-Université de Québec, Acadia, Mount Saint Vincent, Dalhousie, and Memorial. Both Acadia University and Memorial University use four-wire networks. Laurentian University and Cambrian College in Sudbury, Ontario now have access to the 20-port bridge recently installed by the Northeastern Ontario Telehealth Network (NOTN) [10]. Other universities and colleges across the country lease a bridge from these institutions, have arrangements with the local telephone company, or use other third-party services, such as the Darome Connection.

4.1/ Conveners

The most commonly used type of terminal equipment for classroom purposes is Darome conveners with push-to-talk microphones, either purchased or leased from Darome. The unidirectional microphone reduces the amount of noise carried to the other on-line sites and is therefore suited to classrooms or halls. Some institutions, such as University of Ottawa, have tried systems with omnidirectional microphones but found them unacceptable.

4.2/ Electronic Blackboards

Electronic Blackboards have been installed in 15 locations across Canada in conjunction with courses taught (many in French) from the University of Ottawa. As early as 1978, the University of Regina experimented with a microcomputer-based Electronic Blackboard system that it designed to assist in the delivery of a program of university degree credit courses in administration for the Arctic Cooperatives Limited (ACL) [1]. Five units of the Optel telewriter were brought to Memorial University as an experiment for a mathematics course. At present, the visual is one-way only, from St. Johns' to Cornerbrook, Stephenville, St. Anthony, and Goose Bay Labrador. Three more units are planned for the western area of the province. The University of P.E.I. has used the Electronic Blackboard to a limited extent, and Holland College in P.E.I. has used the blackboards to assist in the delivery of an accounting course to three locations.

4.3/ Telidon

Experiments to supplement audio teleconferencing with Telidon technology have been carried out by a number of colleges and universities. In 1982, the University of Calgary used Telidon graphics to add a visual component to a grammar course being offered by the Faculty of Education via audio teleconferencing. Six sites (Canmore, Drumheller, Olds, Medicine Hat, and two in Calgary) "were equipped with the AEL Microtel integrated Telidon unit, a terminal consisting of a special TV monitor, an integrated decoder, a modem, and a keyboard/keypad. Each teleconference site also had a special switching device to select either voice (through a Darome 1610 convener) or data" [11]. Fifty-two students enrolled in the course [1,2,12]. Since this first experiment, the University of Calgary has continued to use Telidon; it owns 13 terminals, which are moved around to different sites. Telidon has been used for teachers and for medical education and administration [11,12,14]. In the winter of 1983, Assiniboine Community College incorporated telidon graphics into two audio-teleconferenced courses offered to farmers in nine rural Manitoba communities, using equipment loaned from the Manitoba Telephone System [1].

4.4/ Slow-Scan

Although slow-scan video has been looked at by more than one educational institution, only the University of Saskatchewan uses it to support educational teleconferencing. Evaluation data for the intern-teachers on a 16-week practicum were transmitted as slow-scan video images from a teleconference centre at North Battleford, Saskatchewan to the University in Saskatoon, thereby replacing the supervision meetings. This was part of the Saskatchewan Telephone Company's experiment with communication technologies. Also, diagrams and brief notes were transmitted as slow-scan images to teach a particular supervisory concept to teaching supervisors at North Battleford [2].

4.5/ Computers

Computers are now widespread in education, but use of computer conferencing to support audio teleconferencing or as a primary means of course delivery is still in the trial stages. The University of Guelph has, however, established a computer network, Northnet, connecting 11 universities in Ontario and Quebec for exchange of data and information on university administration, joint faculty publications, and system maintenance [1]. In the Atlantic provinces, lawyers at the Dalhousie University Law School use data conferencing, and the Association of Continuing University Education plans to "use the technique to support distance audio and video education activities already in place" [1]. Computer conferencing is also being used by the Law Society of Upper Canada for continuing education. Simon Fraser University in B.C. is considering a pilot project in the fall of 1985.

4.6/ Full-Motion

The use of full-motion video to deliver educational courses, whether by satellite or cable TV, exists across Canada. In most universities or colleges, "Telecollege" programs do not involve teleconferencing; that is, they are not interactive. In some instances, toll-free numbers have been provided for call-in comments or questions. However, some activity is taking place. Mount Saint Vincent University (MSVU) in Halifax employs an interactive video system to deliver courses throughout the Maritimes.

University credit and non-credit programs are offered by DUET on the Atlantic Satellite Network:

> The television signal is transmitted by microwave to Halifax Cablevision and Dartmouth Cable Television. From there it is carried over the regular cable network on the channel designated for education in Halifax and Dartmouth....Each receiving centre has a television, a decoder to unscramble the signal, and a telephone which is connected directly to the broadcast classroom at Mount Saint Vincent University ....Maritime Telephone and Telegraph provided the return teleconferencing link over standard telephone lines to the broadcast classroom at MSVU. [1,7]

Dedicated telephone lines, collect-call lines, or a 10-port audio-teleconferencing bridge provide the opportunity for students to participate in the classroom activity at the same time [1].

In early 1984, the University of Saskatchewan experimented with live video programs for veterinarians in the four western provinces. Other programs were also offered. Collect telephone calls permitted interaction to take place, but no true audio teleconferencing was available [13]. Telephone links or audio teleconferencing is also used to supplement courses delivered by cable TV (e.g., at the University of Regina-Extension, University of Victoria, Wilfred Laurier University, and University of New Brunswick). The Quebec consortium Télévision Educative du

Québec (TVEQ) is considering the implementation of a teleconferencing system for use with their courses offered via cable TV [1].

5/ OVERVIEW OF EDUCATIONAL TELECONFERENCING

Due to the rapid growth and expansion of teleconferencing use with educational institutions, it is not possible to present a detailed discussion of every teleconferencing activity within every university and college. Section 5 is intended to give a sense of the range and type of activity within each region of Canada. Readers wishing more specific details are urged to consult the bibliography or the individual institutions directly.

5.1/ Atlantic Canada

In the winter of 1977, Memorial University in Newfoundland offered its first credit course using audio teleconferencing [2]. Today it offers courses to over 60 sites in Newfoundland and Labrador [14].

Mount Saint Vincent University (MSVU) in Halifax offers courses via interactive video to centres in all four Atlantic provinces. Acadia University in Wolfville, N.S. uses its four-wire dedicated audio system to serve 10 communities located in a rough circle around the province. This year, five university credit courses are being offered. Students are given a kit of materials and then meet once a week via audio conferencing. During the 1985/86 year, Acadia plans to extend its offerings to 11 credit courses.

The University of New Brunswick owns both a bridge and the Darome conveners, with which they have equipped eight sites throughout the province. When conflicts arise, bridge time is rented from NB Tel. In 1984/1985, audio teleconferencing was used as the primary delivery mode for three full-year courses. Although no visual enhancements, such as the Electronic Blackboard are used, teleconferences are supplemented by face-to-face sessions and mailed-out material. L'Université de Moncton has joined the University of Ottawa's Electronic Blackboard network for distance education in French [1].

Teleconferencing in P.E.I. is limited, in part, because of the small geographical area of the province. However, the University of P.E.I. does receive programs through the DUET system. Holland College, a technical college in Charlottetown, uses audio conferencing among its three resource centres (one in each county) to support courses and for administrative matters. Both Darome conveners and Conference 2000 units are available in the centres. Electronic Blackboards were used to deliver a six-week accounting course to students in Charlottetown and two stations in east and west P.E.I. The class met one afternoon a week for three hours, with the blackboard used for one and a half hours and the remaining class time conducted by the resource person at each station.

St. Francis Xavier University, Dalhousie University, L'Université de Moncton, Mount Allison University, and St. Mary's University use or have used teleconferencing to a limited extent.

The Office of Educational Communication of the Association of Atlantic Universities functions as a resource centre for the Atlantic provinces. Teleconferencing is among the various areas of communications for which it provides information and training to its members.

5.2/ West Coast

The use of audio teleconferencing by post-secondary institutions on the west coast is increasing rapidly [15]. The first course offered in B.C. via teleconferencing was given by BCIT in 1976. Seven years later, "five post-secondary educational institutions and the educational television authority ...(UBC, Simon Fraser University, the University of Victoria, BCIT, Open Learning Institute [OLI], and Knowledge Network) founded an informal consortium...to co-operate in using audio teleconferencing for course delivery" [15]. Although the consortium no longer exists, the various institutions continue to use teleconferencing for tutorial support, discussions following television-based courses, or in some instances, for direct delivery.

The University of Victoria has experimented with a 10-port bridge, which was used most frequently for tutorials following course broadcasts over KNOW. KNOW itself owns a 20-port Darome bridge, which is used in much the same way. At Simon Fraser University, audio conferencing is used by the Faculty of Education for pre-service and in-service instruction. Five sites in the B.C. interior (Fort St. John, Kelowna, Prince George, Prince Rupert, and Cranbrook) are linked to the university in Burnaby. Teleconferencing is used for course delivery (lectures and seminars) as well as for administrative services such as association meetings.

5.3/ Prairies

Unlike B.C., with its major population centres located in the southwestern corner of the province and teleconferencing activities fanning out from that point, Alberta's centres are located in the north, south, and central interior. From Athabasca University in Athabasca and the University of Calgary and SAIT in Calgary (and, to a lesser extent, from Red Deer College half-way in between) courses are disseminated throughout the province and, in some cases, to the Northwest Territories and Saskatchewan. Athabasca University can reach 30 to 40 sites, with an individual course reaching an average of 10 to 12 centres. Six university-level courses are available this year with a teleconferencing component. The Southern Alberta Institute of Technology (SAIT) is involved in teleconferencing courses both in Alberta and the Northwest Territories. "Approximately 300 remote students in 30 centres, including Fort Smith in the Northwest Territories, [participated] in SAIT's teleconference courses" in 1983/84 [2]. Eighteen courses are being offered during the 1985 winter session [9]. Teleconferencing is also in use at Grant

MacEwan Community College, Fairview College, Grand Prairie College, Lethbridge College, and is beginning at Lakeland College [1,2,3].

Both of the major universities in Saskatchewan have used teleconferencing to deliver courses. The University of Regina has also worked with the Arctic Cooperative Limited to deliver courses to native Canadians in six communities in the Northwest Territories. From January to March 1984, the University of Saskatchewan distributed 40 hours of live video programming via a satellite-cable-fibre-optic network. Viewers and program originators interacted by using telephone lines [13]. Programming included continuing education for veterinarians throughout the four western provinces and courses for "several colleges of the University of Saskatchewan and various external agencies" [13]. Prairie West Community College in Saskatoon and Bigger provided assistance for the development of five teleconference courses offered in 1983 by the Kelsi Institute of Applied Arts and Sciences in Saskatchewan [2].

The University of Manitoba delivers courses to four centres, while Brandon University covers another nine or 10 in the southern and central parts of the province and two in Saskatchewan [1,2]. Assiniboine Community College in Brandon in 1983, and again in 1984, "offered two courses via audio teleconferencing to farmers in nine rural Manitoba communities" [1]. Inter-Universities of the North, which offers courses to 18 centres in Northern Manitoba, is considering the use of audio teleconferencing.

5.4/ Central Canada

With its vast geographical area and well-developed distance education programs, Central Canada has found teleconferencing a useful tool for course delivery or support. The University of Ottawa "began experimenting with the new technology that was being used for teleconferencing to bring the classroom lecture to the students, wherever they were" [16]. In 1981, one course was offered on a point-to-point conference. By 1984, the number of sites had expanded to nine, with 15 courses being taught. The number is expected to double in the next year. The university has also installed a series of Electronic Blackboards, starting in 1983 with one on the main campus in Ottawa and one in the Kanata High Tech Training Centre. In 1984, further boards were installed, in part, to allow the exchange of courses in French across the country: in Edmonton (Faculté Saint-Jean); St. Boniface, Manitoba (L'Institut Pédagogique du Collège Saint Boniface); Moncton, N.B. (Université de Moncton); and Dartmouth, N.S. (Université Sainte-Ann). The other blackboards are located as follows: two more on the main campus, one in Pembroke, one in Alta Vista, and one each in Cornwall and Hawkesbury.

College Universitaire de Hearst, affiliated with Laurentian University, has offered two courses in social work in French. Distance education courses using teleconferencing are expected to expand at Laurentian University and Cambrian College in Sudbury [10]. Since 1982, the University of Western Ontario has given two courses a year employing teleconferencing as a mode of delivery. In 1984-85, one course was given to four locations in southwestern Ontario, while the other linked London, Owen

Sound, and Waterloo in a joint venture with the University of Waterloo's School of Nursing. Limited use of teleconferencing is reported to have begun at York University [2].

The Ontario Institute for Studies in Education (OISE) is unique in using audio teleconferencing as part of its delivery of graduate courses in distance education. Graduate courses place high emphasis on seminar work and interaction not only between students and faculty but also among the students themselves. Whatever mode of delivery is used there is a need for immediate, direct, personal, and collaborative interaction. OISE has been experimenting with distance education and running an increasing number of courses since 1982. Audio teleconferencing is not used for information transmission but, rather, as one of a variety of means to facilitate interaction. As the institutions's calendar points out:

> Distance mode courses use specifically designed mixes of learning activities and multi-media resources, integrated with regular class meetings with the instructor. Students will be expected to attend at least two face-to-face workshops with their instructor (one at the beginning and one at the end of the course) at a designated site, either in or close to their home area. In between these workshops, students work in their home sites and communicate with their instructor in the scheduled telephone-based workshops. These are arranged at the start of the course. OISE supplies expertise and equipment to help establish these activities. [17]

Audio teleconferencing can be use for both student-oriented functions, such as peer teaching and learning or challenging comments and ideas from faculty and other students, and faculty-oriented functions, such as clarifying results from student work, giving support, correcting errors, and broadening or deepening student comments or ideas. Whatever the focus, the emphasis in audio teleconferencing is always interactive. Students come to audio class already engaged in a number of activities in the course. As a result, audio teleconferencing becomes one of the diverse means by which graduate students at OISE use the distance education mode to meet their learning needs.

Confederation College in Thunder Bay employs teleconferencing in a similar mode. Students working on their own time and schedule meet with others taking the same course to "accomplish group learning tasks, such as discussion exercises, seminar presentations, and practice of specific skills" [18]. "The telephone discussions were not intended to deliver factual or technical information but were to answer any questions or concerns of the students after their individual and group study" [18]. The University of Waterloo is into its second year using audio teleconferencing as a support system, conducting seminars and tutorials in this way [9].

Teleconferencing activities in Quebec originate from the Télé-Université, a French-speaking distance education institution that is part of the Université du Québec. Print material is the major form of course delivery, with limited support by telephone and teleconferencing, largely used

as learner support tools. Students may call the institution on toll-free telephone lines to share questions, insights, and learning experiences with their instructor and other students via teleconferencing. Telephone use breaks the isolation and often replaces face-to-face meetings for many courses [1].

6/ ISSUES IN EDUCATIONAL TELECONFERENCING

The issues involved in educational teleconferencing are of two types:
1/ those having to do with individual courses, instructors, students, or delivery; and
2/ those dealing with concerns important to any or all institutions using, or considering using, a teleconferencing medium.

Some of these issues emerge as part of the concerns of distance education as a whole, regardless of delivery mode; others emerge with the use of the new technology [1].

6.1/ Trans-Border Delivery and Credit Transfer

Like the mail system, teleconferencing can go into virtually any area of the country. Individuals in Canada, separated by great distances, can be bridged together for a course as long as they have access to a telephone. Education, however, is a provincial affair, so trans-border course delivery and credit transfer (acceptance among institutions) become issues. With the need to provide specialized courses and to serve areas with sparse populations, and the reality of budget restrictions, there is an increasing need for co-operation among institutions. Not only do institutions need to agree on credit transfer, but there needs to be a sharing of resources from the technology (audio terminals, bridges, etc.) through course design to delivery.

A number of co-operative ventures have already been tried or established. For example, the Atlantic Provinces Association of Continuing University Education has created mechanisms for professors to share services, for resources sharing, and for minimal program overlap [1,2]. A consortium was tried in B.C. (UBC, Simon Fraser, University of Victoria, BCIT, OLI, KNOW) to pool "resources and expanding educational services at a reasonable cost to distant learners throughout the province...[15]. The University of Ottawa, in 1984, began a trial program to offer courses to French-speaking students in five provinces [1]. The University of Waterloo held a national seminar in Canadian studies for 13 students, including participants in Fort Smith, N.W.T.; Newfoundland; Nova Scotia; Manitoba; and B.C. [9]. Other Associations and committees are concerned with related issues: the Association of Atlantic Universities, Western Council on University Distance Education, Canadian Association for Distance Education, Committee on Distance Education by the Council of Ontario Universities, and task groups of the Council of Ministries of Education [1].

As new technology makes it increasingly easier to deliver any course to any combination of students throughout the country, the necessity for

inter-provincial co-operation will become acute. "Ministers responsible for basic and post-secondary education in the four western provinces and the Territories have recently signed an Inter-Provincial/Territories Distance Education Agreement and established an Inter-Provincial/ Territories Distance Education Committee (I/T DEC) designed to facilitate sharing of research and development expertise, as well as programs of study across these jurisdictions" [19]. Consortia of users of satellites for distance educational services are "mandatory in order to address both managerial and administrative issues, as well as to take advantage of the multi-media, multi-channel capacity of this technology and its capacity for low cost, distance-independent information transmission" [19].

In April 1984, the Canadian Association for Distance Education held a two-day professional development workshop called "The Design of Effective Distance Education Learning Processes." Two hundred and fifty people in 18 centres from Vancouver, B.C., to Frobisher Bay, N.W.T., to St. John's, Newfoundland were linked by audio teleconferencing. Representatives attended from 28 universities, 24 colleges, various government departments, and other learning institutions. In May of 1985, two more national workshops were held using teleconferencing. The workshop on "support systems," in part, addressed the question of teleconferencing and distance education.

6.2/ Regulations

Institutions using or planning to use video teleconferencing may be faced with issues involving the Canadian Radio-television and Telecommunications Commission (CRTC) regulations [20]. With joint courses being designed, the question of course material copyright will arise.

6.3/ Training, Delivery, and Support

Using teleconferencing for the delivery of distance education courses raises further questions concerning the training of faculty and students. Teleconferencing's greatest strength -- its interaction -- can become a threat to some instructors and students who are used to lecture-style courses with faculty-controlled classes. For others, this interaction provides an exciting challenge and new opportunities for greater student involvement in their own education and greater freedom for changes in teacher and student roles [2]. Although there are general guidelines in the literature for use of the technology, there is a lack of information on "teaching behaviours in effective employment of audio teleconferencing" [21].

Faculty must also receive due credit for the time and effort involved in preparing courses using teleconferencing. As distance education courses increase in demand, the nature of their delivery and support will also come into question. Concerns, such as changes in the administration of courses, deadlines for assignments, forms of testing, academic equivalency, availability of resource material (including counselling services), are as relevant to teleconferencing as to the entire field of distance education.[6]

6.4/ Need of New Technology

The use of new technology in distance education also raises the question of the need for the technology. Does it advance the cause of education -- and if so, how? Is it being used to achieve stated educational goals or just for its own sake [1,22]? Teleconferencing can be a means of increasing learning or a stumbling block to it. For Burge et al, it is important to adopt "a learner-centred view and to ask to what extent the technology is likely to support learning rather than dominate it. The use of technology should add flexibility for the learner -- an alternative, more effective, more personally appropriate way of learning" [1].

6.5/ Financing

For some people the biggest problem with technology in education may be the financing of the equipment and technology [13]. As the cost of hardware and transmission comes down, video teleconferencing, Telidon, or Electronic Blackboards may become more widely used. But for many institutions, the use of the cheaper and more flexible audio conferencing will continue to provide the opportunity for interaction in distance education.

6.6/ Evaluation

One further issue of importance is that of evaluation. Given the number of universities and colleges offering distance education courses via "correspondence" (print or print with audio cassette), television, or radio, the question of academic equivalency of distance education courses to on-campus courses has been resolved or at least accepted (on paper). There remain two questions:

1/ If the delivery mode is changed from face-to-face with a professor addressing a class in a classroom atmosphere to a teleconferenced mode, whatever the configuration, is there an equivalency of learning?

2/ In the other direction, does the inclusion of audio teleconferencing add significantly to the learning experience of students taking distance education courses by print, TV, or radio?

The small amount of data available in Canadian teleconferencing and the experience south of the border would suggest a positive answer to both of these questions. An early (1980) comparison done for a Tests and Measurement course in the department of Educational Psychology at the University of Calgary revealed interesting findings. Although the sample was small, the results suggest positive comparisons similar to those found in later studies. Comparisons were made on four tests between an on-campus group and the teleconferenced group. Donald Black reports:

> It can be seen that the teleconferencing course performance was the same as that of regular students in the author's classes for two of the tests, and clearly superior on two others. Further, their overall

> performance was superior to regular students, not just due to their superiority on two tests, but because their individual performances were far more consistent. [23]

At the University of Ottawa, for PSY 1200, a course given both on and off campus (same course content), the students in the teleconferenced course had a 10% higher average than the students on campus [16]. Memorial University found similar results in a course in child development offered in 1980 by the Faculty of Education. Students, both on and off campus, "were compared in terms of their general impressions of the course, instructor, and evaluation; and also in terms of their test, assignment, and final grade scores" [24]. The conclusion drawn was that although there were differences in the scores of each group for different questions, the teleconferenced course was a success. Students taking DUET courses at Mount Saint Vincent University have also performed better than their on-campus counterparts [8].

Like most researchers, Jeffery presents his conclusions on Memorial's course with some caution. In 1980, very little educational teleconferencing had been done in Canada, and even in 1985 little comparative data is available. Although the studies may be positive, it is impossible to know whether the off-campus students would have done better, worse, or similarly than the on-campus students had they all been on campus. Since most teleconferenced courses are offered on a rotating basis, or as they are needed for a particular program, little opportunity has existed for running the test comparisons twice on the same course in consecutive years.

Feedback sheets and questionnaires can provide relevant information from the students themselves as to the value of teleconferencing. After the University of Calgary's Telidon trials, feedback was sought to see whether it was possible to use Telidon along with audio teleconferencing and if it was worth doing. The answer was yes [12]. Other universities and colleges have had both formal and informal positive feedback from students.

At the University of Western Ontario, from the comparison of the two modes of course delivery drawn from student response, Haaland and Newby drew some conclusions regarding the relationship of delivery mode to student perception of instructor and course quality:

- The delivery mode itself, whether teleconference-based or conventional, had no effect on the students' overall rating of the course.
- The delivery mode itself, whether teleconference-based or conventional, had no effect on the students' rating of the instructor's ability [21].

Such studies are important, not only as reassurance that students are losing nothing by taking a teleconferenced course, but also to provide an understanding of the types of instructor behaviour which are most conducive to good teleconferencing.

Without an understanding of what is most effective, it is impossible to train instructors, and teleconferenced courses must be selected from those with instructors who "already know how to be effective" or who are left to chance for their effectiveness.

The empirical evidence for stating that students in teleconferenced courses do as well as students in on-campus courses is limited. Impressionistic evidence would suggest, nonetheless, that this is true. The success of the University of Wisconsin-Extension's almost 20 years of educational teleconferencing and the growing acceptance of it in Canada might suggest its applicability, if not its necessity. Further studies will be needed to determine which types of courses can or cannot, should or should not, be taught. For example, questions have been raised as to the viability of teaching courses in social work via audio-only teleconferencing. Can courses with a high level of emotional content be conducted without a visual medium? Can professional education in fields that involve client contact be successful in this medium?

7/ CONCLUSION

Educational teleconferencing has developed in Canada out of necessity: receiving a course by telephone is better than not receiving it at all. With Canada's vast areas of scant population, harsh winters, and limited budgets, not receiving a desired education has been a reality for many. Teleconferencing provides one of the means to correct this situation and a support system to reduce feelings of isolation for those pursuing their education through other self-study means.

As the technology develops or costs are reduced, distance education will have more opportunities to serve the needs of Canadians. Continual research and study is needed to ensure that teleconferencing is used to meet these learner needs and not to satisfy other peripheral interests.

8/ ENDNOTES

[1]See chapter on Telehealth; Reference 1; Reaching Out; videotape on Tele-education for Nurses produced by the University of Ottawa.

[2]Personal conversations were held with the following people and institutions, and the information is used throughout the text:

Barnell, Connie, Dept. of Extension and Summer Session, University of New Brunswick.

Burge, Elizabeth, Distance Education Project, Ontario Institute for Studies in Education (OISE).

Burge, L. and J. Barr, OISE.

Deveau, Leo, Continuing Education, Acadia University.

Franks, Ian, University of British Columbia.

Haaland, Bonnie, Faculty of Part-Time and Continuing Studies, University of Western Ontario.

Landsburg, June, Faculty of Education, Simon Fraser University.

MacDonald, Ian, Continuing Education, University of Prince Edward Island.

Mandeville, Malachy, Continuing Education, Memorial University of Newfoundland.

McDonell, Donald, Co-ordinator of Teleducation, Continuing Education, University of Ottawa.

Picot, Jocelyne, Office of Educational Communication, Association of Atlantic Universities.

Shaw, Sam, InterUniversities of the North (Thompson, Manitoba).

Staff, Faculty of Continuing Education, University of Calgary.

Taylor, Robert, Holland College, P.E.I.

Thomas, Noel, TVO.

Zuckernick, Arlene, University Extension, University of Victoria.

[3]Both the number of sites linked and the number of courses using teleconferencing in some form are changing rapidly. Universities and colleges are responding to the needs and desires of their students. Readers wishing details on any institution should consult that institution directly.

[4]For specific course offerings, contact specific institutions.

[5]cf. chapter on Telehealth.

[6]Reference 2; Ellis, Higher Education, p. 8-9.

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Table 1/ Universities and Colleges Having Experimented with Tele-conferencing for Delivery or Support of Distance Education

UNIVERSITIES

Newfoundland
Memorial, St. John's

Nova Scotia
Mount Saint Vincent, Halifax
Dalhousie, Halifax
Saint Mary's, Halifax
Sainte-Anne, Dartmouth
Acadia, Wolfville
Saint Francis Xavier, Antigonish

New Brunswick
New Brunswick, Fredericton
Moncton
Mount Allison, Sackville

Prince Edward Island
Prince Edward Island, Charlottetown

Quebec
Tele-Universite, Quebec City

Ontario
Ottawa
Western Ontario, London
Waterloo
Wilfred Laurier, Waterloo
Laurentian, Sudbury
Guelph
York, Toronto

Manitoba
Brandon
Manitoba, Winnipeg

Saskatchewan
Regina
Saskatchewan, Saskatoon

Alberta
Lethbridge
Alberta, Edmonton
Calgary
Athabasca

British Columbia
British Columbia, Vancouver
Simon Fraser, Burnaby
Victoria

Table 1/ Continued

COLLEGES

Holland, Charlottetown, P.E.I.
Ontario Institute for Studies in Education (OISE), Toronto, Ont.
Hearst College, Hearst, Ont.
Confederation, Thunder Bay, Ont.
Assiniboine Community College, Brandon, Man.
L'Institute Pédagogique du Collège Saint Boniface, Man.
Kelsi Institute of Applied Arts and Sciences, Saskatoon, Sask.
Lakeland -- on Alberta/Saskatchewan border
Olds, Alta.
Fairview, Alta.
Grand Prairie Regional College, Alta.
Red Deer, Alta.
Grant MacEwan Community College, Edmonton, Alta.
Faculté Saint-Jean, Edmonton, Alta.
Southern Alberta Institute of Technology (SAIT), Calgary, Alta.
British Columbia Institute of Technology (BCIT), Vancouver, B.C.
Open Learning Institute (OLI), Vancouver, B.C.

The authors express their regrets to any overlooked users.

PART 9/

THE TELECONFERENCING MARKET: PAST AND PRESENT PROSPECTS

1/ INTRODUCTION

While use of teleconferencing in Canada is growing steadily, a number of factors have influenced the development of the market: the nature of the job or activity; costs/benefits; user awareness and attitudes at the organizational and individual level; product availability, quality, and marketing; and government policies.

2/ NATURE OF JOB OR ACTIVITY

Teleconferencing is not suitable for all meetings. Technology will never replace the high touch of face-to-face interaction. It, however, is ideal for structured, task-oriented meetings, information exchange, planning, co-ordination, problem solving, and training. It is less appropriate for complex interpersonal tasks, negotiation or bargaining, dealing with sensitive issues, or initial meetings where people are "getting acquainted" (Table 1). Obviously, video conferencing allows for a wider range of meetings, even, in some cases, job interviews or doctor/patient consultation. But, there are simply some meetings that cannot be teleconferenced. Studies have been done which estimate that many or most business meetings involve activities which could be teleconferenced (Table 2).

3/ COST BENEFITS

For rational or economic consumers, the costs and benefits of teleconferencing are important. The benefits of teleconferencing have been well documented: cost reduction, such as travel dollar and time savings; added-value benefits, such as improved communication, increased participation, and efficiency. Some of these benefits are, however, difficult to quantify. The costs differ dramatically with the technology, from $40 per hour for audio to $1300 per hour for satellite video transmission. For some applications, teleconferencing is clearly not cost effective: the longer the meeting, the closer teleconferencing comes to travel costs. Travel costs are not time sensitive; teleconferencing costs usually are.

While guidelines have been suggested for evaluating costs and benefits, it must be done on a case-by-case basis. In addition, prospective users require sufficient information to make an informed decision. The costs of certain forms of teleconferencing, particularly full-motion video, discourage users. There is some evidence to suggest that non-users believe teleconferencing is expensive, but it is not clear whether or not this is based on accurate knowledge of costs. Finally, economic and technical trends have and will continue to affect the development of teleconferencing: as travel and staff costs rise and telecommunications costs fall, teleconferencing becomes more attractive. For example, in 1978, it was estimated that while travel costs increased by 40%, teleconferencing costs decreased by 10% [1]. Meeting requirements are, therefore, an important factor influencing the decision to teleconference.

4/ USER AWARENESS AND ATTITUDES

While awareness of teleconferencing has increased dramatically in the past few years, many prospective users have an incomplete understanding of the range of technologies and their applications. This is a problem at the organizational level as well as among individual employees. Many organizations have not investigated teleconferencing thoroughly. In other instances, organizations have decided to introduce the technology, but employees are not fully aware of its availability or applications or are resisting it due to habit, technophobia, or inadequate training. For this reason, the frequencies of teleconferencing vary dramatically among organizations.

The problem of awareness and acceptance must, therefore, be addressed at both the macro and micro levels. The government launched a comprehensive program to increase awareness of teleconferencing in 1980. Since then suppliers have begun actively marketing their services, and within organizations, comprehensive promotional programs are being undertaken to orient users. While significant gains have been made, awareness and acceptance are still key problems in developing the Canadian teleconferencing market. Once organizations decide to introduce teleconferencing, systematic implementation is needed to maximize use.

Experience has shown that in some cases the most adamant opponents of teleconferencing become its biggest supporters once they begin to use it. While non-use can be a function of negative attitudes, use often changes attitudes to teleconferencing. Awareness of the costs and benefits of teleconferencing is important. The extent of use within an organization is affected by the way in which it is introduced.

Senior management support of teleconferencing by dictate or example is probably the single most important factor affecting use. The TEMP survey indicated that 70% of users felt that this support is essential [2].

Policies such as travel restrictions can be used to encourage teleconferencing. About 68% of user firms have taken steps to reduce business trips [2]. Even temporary external restrictions on travel tend to increase use of teleconferencing. The American air traffic controllers' strike in 1981 contributed to a 6 to 7% increase in the use of teleconferencing in the US as alternatives to air travel were actively sought [3].

User training is essential to the success of teleconferencing. Without it even the most elaborate system may fail. Prospective users must be

- persuaded of the benefits of teleconferencing,
- able to use the system in a competent fashion and deal with problems if they arise,
- know when teleconferencing is appropriate, and
- adapt their meeting behaviour to the medium.

For these reasons, the introduction of teleconferencing is fairly labour-intensive -- a great deal of hand-holding is required in the early stages.

Promotion is closely allied to user training. Over 40% of users surveyed strongly believed that once someone knows the facts about teleconferencing they will make use of it.[3] Essentially, an internal marketing effort -- presentations, pamphlets, posters, and memos -- is required. It is particularly important to allay fears that teleconferencing will replace all travel.

Administrative support both in terms of qualified staff and established procedures will facilitate the introduction of teleconferencing. Local co-ordinators must be available to resolve problems, book the facilities, and provide continuing promotion and training.

5/ PRODUCT AVAILABILITY, QUALITY, AND MARKETING

In Canada, the supply of teleconferencing hardware and services was fairly limited until 1982. In that year a number of new products and services were introduced, including Bell Canada bridging services, Conference 200, and Conference 300. Darome Canada was founded in the same year, marketing hardware in Canada, and in 1983, the Darome Connection, another meet-me service, was established. With relaxation in terminal attachment regulations, a variety of new products have appeared on the Canadian scene, many of which had been available south of the border for many years.

Problems with the technology still persist, but advances in digital techniques promise to improve audio transmission, terminals, and bridges as well as reduce the transmission time for freeze-frame video and the costs of motion video. Moreover, the integration of technologies in the electronic office is yielding a new generation of user-friendly, multi-functional work stations which allow teleconferencing using a variety of media. Finally, reductions in the cost of satellite transmission and earth stations are expected to contribute to the growing market.

Marketing of teleconferencing systems and services is still a problem. While Bell Canada and other Canadian telecommunications companies have stepped up their promotional efforts, many smaller companies have inadequate marketing support, and hence, awareness of some technologies, notably freeze-frame, is lacking.

6/ THE GOVERNMENT AS CATALYST

Some researchers and policy makers have argued that government intervention is essential to ensure that the opportunities presented by telecommunications are exploited and the threats posed are avoided. Government policies for transportation, telecommunications, and urban and regional planning all influence the substitution of telecommunications for transportation and the resultant energy savings [4]. While other governments have extensively researched the subject, the provincial

government of Ontario has played a unique role developing specific policies and initiatives to actualize the energy-saving potential of telecommunications.

While the American market was taking off, the Canadian market, even in 1981, was relatively inactive. One researcher lamented that improvements were unlikely to take place "except at a snail's pace" unless driven by users, based on their perception that effective teleconferencing will save them money, or government, based on the national interest in terms of energy saving or efficient use of the communications system [5].

The potential energy savings represented by teleconferencing were the primary rationale for government involvement. It was estimated that teleconferencing had the potential to reduce transportation energy consumption by 2% [6]. Another was the economic benefit of development of the telecommunications industry. Finally, it was felt that the government was in position to hasten the development of the market and the achievement of the benefits.

In 1980 as part of its Transportation Energy Management Program (TEMP), the Ontario government created an inter-ministerial task force to promote the use of teleconferencing as a substitute for travel, first in the government itself, and then in the private sector. While research had suggested that teleconferencing could substantially reduce the need for travel to business meetings, it was not used extensively in Canadian industry.

A number of barriers to teleconferencing had been identified. First and foremost was the lack of awareness. Bell Canada had a few products, conference calling and group terminals, but made little effort to market them, and CNCP's four-wire teleconferencing service was a well-kept secret. The products themselves had certain limitations: the audio quality was not particularly good and voice switching was obtrusive. TEMP's strategy addressed both dimensions of the market -- the users and the suppliers.

At its disposal were a number of tools: publicity and promotion; research and development sponsorship; experimentation and demonstration; subsidies and taxes, regulations, and its position as a major customer.

Kenneth Kraemer [4] identifies a number of ways in which government policies could be used to reduce the attractiveness of travel, encourage the development of communications alternatives, and increase understanding. TEMP's efforts addressed the following main objectives:

- Demonstrate the benefits of teleconferencing.
- Increase awareness of teleconferencing and the options available.
- Provide training and implementation assistance.
- Encourage the development of new products and services.
- Conduct research into the technology, applications, and techniques.

6.1/ Demonstrations

To investigate the benefits of teleconferencing, the Ministry of Transportation and Communications established an in-house, monitored demonstration project. As a first step, an in-depth study of user needs was undertaken. Based on the results, systems were designed. User training and promotional programs were fairly extensive as the studies had revealed little knowledge of or interest in teleconferencing. Finally, a formal evaluation and monitoring system was used both to identify problems and collect data on use. The results of the 18-month trial were promising. Based on user comments, it was estimated that 88% of the teleconferences had replaced face-to-face meetings, resulting in about $50 000 worth of avoided travel costs and 2000 hours of avoided travel time [7]. In addition to providing concrete evidence of the benefits of teleconferencing, the demonstration helped MTC acquire expertise with the technology implementation of teleconferencing.

In addition to providing a test bed for teleconferencing, TEMP assisted other organizations in establishing teleconferencing demonstrations. Polysar established an audio teleconferencing project with encouragement from the government. The University of Ottawa received funds to help set up an audio system and Electronic Blackboard for educational purposes.

6.2/ Publicity

Drawing on its experience as a user as well as published and unpublished sources, TEMP then developed a comprehensive promotional package on teleconferencing. Included were documented case histories, information on the technology available and a catalogue of suppliers and prices, and guides to non-technical factors in implementation and user training. In addition, a programmed audiovisual show and posters were developed. These self-help materials were made available through direct mail and on request.

Members of the task force actively promoted teleconferencing by making presentations to associations and individual companies. Hands-on demonstrations were also held for small and large groups. In essence, a full-fledged marketing communications program was undertaken.

6.3/ Training and Implementation Assistance

While information was provided on system design, the task force, for obvious reasons, avoided offering advice on product selection. They did, however, provide free consultation and assistance with implementation. The government experience had shown that regardless of the technology, user training and promotion were probably the most important factors affecting the success or failure of a teleconferencing system. Task force members conducted training sessions with the government and in a number of companies.

6.4/ Development of Products and Services

One of the main impediments to the widespread adoption of teleconferencing was the lack of products and absence of vendor marketing. Most systems had been initiated by users, rather than sold by suppliers. Teleconferencing represented a small portion of Bell Canada's revenue, and many of its sales staff were unaware of the products available.

Here the government exploited its position as one of the largest customers of telecommunications in Ontario. Bell Canada was encouraged to set up an in-house demonstration project to assess the value of teleconferencing [8]. This TEMP-inspired project is one of the key factors credited with creating interest in teleconferencing among Bell Canada's senior management and stimulating development of Bell's marketing effort [9]. In 1985, there are several product managers responsible for teleconferencing at Bell and a comprehensive marketing program has been developed. Teleconferencing is featured prominently in the company's promotional materials.

6.5/ Research

To supports its role as a disseminator of credible information, the government has also sponsored a number of research projects on teleconferencing. Subjects appear to have been more willing to co-operate than if a supplier had sponsored these activities. One study, a survey of 300 large businesses in Ontario, was particularly fruitful. Not only did it represent the only source of information on the extent of teleconferencing in the province, but it provided leads on organizations interested in receiving more information, thus supporting the marketing effort. By 1982, 75% of large companies indicated that they were using some form of teleconferencing but required information and further assistance.

6.6/ Results

Because of the project's modest budget and the size of the task, no formal evaluation of TEMP's impact was undertaken. Still, while quantifiable proof of its success is lacking, others suggest that the impact of the program was substantial and that the role played by government was appreciated by both users and suppliers. In March 1985, the TEMP teleconferencing group concluded its formal activities with Teleconference '85, a seminar for 100 people.

7/ OUTLOOK

In 1982, Bell Canada estimated the Ontario/Quebec teleconferencing market at $10 million dollars. Of this, 3% was full-motion and the rest was audio. The company estimated that by 1990, the market would have grown to $100 million dollars, with audio accounting for 43%, audio plus visual support 47%, and motion video 10% [10]. The validity of the specific projections aside, it is clear that the teleconferencing market in Canada will continue to grow, but the rate of the growth will depend on various factors, including suppliers, users, as well as economic, social,

technical, and political trends.

The user, both the organization and the individual, makes the decision to teleconference based on his or her perception of the following:

- the application of teleconferencing to his/her needs
- the costs/benefits
- the availability/quality of the technology

To facilitate the development of teleconferencing in Canada, therefore, it is important to ensure that users are well informed and that the technology is available and acceptable from the perspectives of quality and pricing.

8/ ENDNOTES

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Table 1/ Characteristics of Meetings

Easily Teleconferenced	Require Caution
Short, structured, task oriented	Negotiations and bargaining
Participants know each other	Conflicts
Exchange of information, ideas, opinions	Complex interpersonal tasks
Committees	Situations where rank or status is important*
Updates, status reports, reviews	Disciplinary sessions
Planning for programs, projects, or face-to-face meetings	Sensitive issues, e.g., performance reviews
Co-ordination	"Get acquainted" meetings*
Training and education	Meetings where participants are working in a second language
Problem solving, especially in emergencies	Meetings where body language and facial expressions are important*
Administration	
Inventory control	
Presentations and lectures	
Interviews where knowledge/skill is important	

*Video teleconferencing has been used successfully for these meetings.

Table 2/ AT and T Study of Meeting Activities

Sharing information	35%
Solving conflicts	20%
Providing status	16%
Presenting reports	11%
Convincing	9%
Negotiating	8%

Source

Olgren, Christine H. and Lorne A. Parker, Teleconferencing Technology and Applications, Artech House Inc., Dedham, Mass., 1983. [1]

Ontario

Ministry of Transportation and Communications
Hon. Ed Fulton
Minister

Ministry of Energy
Hon. Vincent G. Kerrio
Minister